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ELECTRICAL WORLD AND ENGINEER.

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THE INSTITUTE LIBRARY.

A very interesting development has occurred in connection with the library of the American Institute of Electrical Engineers. It appears that at the time the Latimer Clark Library was being offered for sale, Mr. Andrew Carnegie was advised of the fact through more than one channel, and intended to buy it and present it to the Institute, as the proper repository or trustee in this country. Dr. Wheeler, however, with swift generosity, determined that delay should not let the opportunity slip away, bought the library by cable direct from the Clark heirs. This notable exhibition of disinterested professional spirit pleased Mr. Carnegie hugely, and he forthwith offered to give the Institute a sum equal to that of the price of the library, so that the Institute could house, catalogue and round it out progressively. Mr. Carnegie, in thus seconding the noble gift of Dr. Wheeler, has in a manner that cannot be too highly commended, paid over to the Institute a sum of about $7,000 for this use. The gift, while not so conspicuous as many of his other "grants in aid" of literature, is likely to be as beneficial as any of them.

We feel sure that actions like those of Dr. Wheeler and of Mr. Carnegie—who began his wonderful career in the field of telegraphy —must stimulate to supplemental gifts the general body of the Institute membership. They will doubtless be glad to learn that Mr. Carnegie has expressed his great pleasure at the work the Institute is doing for the profession it represents, and that he has conveyed to his representatives the desire that consulting and constructing electrical engagements in regard to any of his various enterprises shall be entrusted only to Institute members in good standing. Whatever may be the low opinion of his friend, Mr. Schwab, as to the value of education, it is evident that Mr. Carnegie rates highly professional status and accomplishments based on expert technical knowledge.

TELEPHONIC RECONSTRUCTION.

For seventeen years the Bell telephone system enjoyed a monopoly that was probably the most thorough thing of the kind ever known in this country. Such undisturbed possession should certainly have left it strongly entrenched, not perhaps in the affections of the people, but in the creation of a system, the establishment of its network of exchanges and circuits, and the forestalling of competition. In many parts of the country such is actually the case, but the report made by President Sabin from the Central Union Bell territory reveals an extraordinary condition of exactly the opposite nature. There have been two or three years of active competition, and the Bell system in that prosperous, progressive region is already seriously in the minority. More than that, it is bankrupt. It is not paying dividends, the stock is selling at less than 40 cents on the dollar, and now President Sabin says he needs $5,000,000 to put the system in proper shape. If this be true, and no reason exists for questioning the statements made in our issue this week by Mr. Sabin, what a hollow shell and sad wreck the Central Union system must be! He has a task before him that no man living can envy.

The only inference to be drawn from Mr. Sabin's confession of what he finds is that the profits of the telephone business have been over-rated, and that to neglect the costly work of necessary maintenance and reconstruction is suicidal. In the evidence given by Mr. Bethell, of the New York Telephone Company, before the Industrial

Commission last week, it is clearly shown that to change from overhead to underground wires and from individual battery to common battery, has already cost that company millions of dollars. But if they had not spent it, where would they be? For one thing, they would assuredly be an "easy mark" for any active opposition, and that is just what the Central Union is now discovering itself to have become. On the other hand, those independent companies which have gone in for low rates, large dividends, and lax repairs have a large score piling up ahead of them, which they will have to pay just as much as their Bell opponents. The amounts of money that will have to go into telephonic reconstruction and expansion the next five years are enormous, and difficult to overestimate.

DIELECTRIC LOSSES IN CONDENSERS.

Mr. Steinmetz's article, published this week, contains some very interesting conclusions. It would seem that the condensers which he has been testing are among the most efficient electric storage devices known, since they waste only about the one two-hundredth part of the power which they temporarily store, as measured in volt-amperes. It is also shown that in the case of the condensers tested, the power factor (average about 0.005) is practically independent of the frequency. This means also that the power expended increases directly with the frequency and in the same proportion as the apparent power. In other words, as the frequency increases, so does the apparent power, or the power stored cyclically in the condenser, and so does the power wasted in the dielectric. The power per cycle is, therefore, constant for a given constant sinusoidal impressed voltage. And just as the hysteretic loss of iron is known to be constant per cycle for a given range of magnetic induction, whereby the hysteretic loss is in direct proportion to the frequency, so the dielectric hysteresis appears to be a definite quantity per cycle and to increase in proportion to the frequency. Moreover, the loss of power increases as the square of the e. m. f. applied to the condenser, just as in the case of power thermally lost in a resistance. This is different from the case of magnetic hysteresis, which varies approximately with the 1.6 power of the flux density, indicating that the physical natures of magnetic electrostatic hysteresis are probably fundamentally dissimilar.

The subject of the virtual dielectric resistance or virtual dielectric conductance, is of great practical importance in subterranean cables for the transmission of power. It is quite possible that a cable having a relatively large virtual dielectric resistance or relatively large power factor might have a relatively low conductor resistance, and yet waste a comparatively large amount of power in the course of a year in its dielectric, just as though it had a greatly reduced cross-section of conductor and expended the heat under load in the metal. In other words, a small conductor cable with a low power factor, in connection with a high-tension alternating-current system, might be as expensive in power and coal as a large conductor cable with a large power factor. Much discussion has recently been directed to this subject in London, where it was announced that the power factor of a certain five-mile length of cable in commercial service was as large as 12½ per cent. It seems, however, that this result was exaggerated by errors in the wattmeter employed for the measurement, since it is known that small power factors are liable to relatively large errors in their measurement, and that the actual power factor of the cable was approximately 3.4 per cent. This only shows that the time may come when the limit to high potentials shall be determined more by the dielectric losses than by their conductor losses or by the limitations of insulating materials to withstand electric stresses.

INDUCTION MOTORS AND THEIR KIN.

It is a good thing sometimes to realize that induction motors, by whatever theory they may be treated, are in their essential particulars very much like other motors, that they obey the same fundamental laws and can be considered in the same straightforward way. The little motor due to Fischer-Hinnen and described in this issue is such a capital example of the derivation of an induction motor from a direct-current form that we cannot forbear calling particular attention to it. It does not seem to represent any revolutionary improvement in induction motor practice, but it should prove convenient for certain cases of small motor work. Its principal interest lies in the fact that it is derived directly from an ingenious but obsolete direct-current motor that came to grief through the use of brushes, which obviously are avoided in Fischer-Hinnen's design. A motor having windings only upon the armature is an old device that might have proved useful in small machines had it not been afflicted with irremediable sparking. Now realizing that, barring sparking, such a structure could readily be used, it was a clever flank movement to introduce the working current into the armature by induction, while retaining the field displacement necessary to give a direct starting torque. The duplex construction of the field magnets and armature attains the same end in directing the torque, as was reached by taking the original direct-current motor, feeding it with alternating currents and displacing the brushes—a scheme which was really Fischer-Hinnen's starting point, it appears, and which we have here carried back a step further.

Induction motors are really much closer to ordinary direct-current motors, both in theory and practice, than is generally understood. Take, for example, the definition of the properties of an induction motor in terms of slip, as evolved in the course of the common rotary pole theory. One finds a very pretty set of relations between current, torque, output and efficiency, that seem at first sight quite peculiar to induction motors, and a most valuable deduction from the fundamental rotary pole treatment. But if one assumes as the "synchronous speed" of a shunt motor that speed at which the counter e. m. f. equals the impressed e. m. f.—the latter being assumed constant, as in the former case—one can derive a set of motor equations in terms of slip fully as interesting and valuable as those obtained for the induction motor. For instance, in each case the armature loss is to a very close degree of approximation directly proportional to the slip, when taken in terms of the output. That is, if an armature of either kind has a slip of 5 per cent, there is 5 per cent loss of motor efficiency to be charged to the armature. And, in fact, one could at a pinch evolve a fairly complete working theory of the shunt motor in terms of an hypothetical constant rotary field. Such an exploit would have little value outside of academic circles, except that it would serve to emphasize the fact that induction motors are not so far removed from other motors as has sometimes been supposed.

Laying theory aside, the fact is that the modern polyphase induction motor is, as a hard-working every-day machine, to be regarded as belonging in the same category as other motors. It has both immunities and troubles of its own, but by and large it will stand more hard knocks than almost any machine with which we are acquainted. Even the single-phase motor—to which class Fischer-Hinnen's machine belongs—is coming to be looked at with more tolerance and less suspicion than in the past. There have recently been recorded some very creditable performances from such motors, and there are still not a few instances in which only single-phase current is available, and in which self-starting single-phase motors obviously prove a real boon.

MAGNETIC UNITS

It is important that the action of the recent International Electrical Congress, held at Paris in 1900, should receive the widest recognition among engineers in connection with the two magnetic units which they officially christened. The action of the Paris Congress of 1900 was in one respect very different from that of prior electrical congresses, because whenever the prior electrical congresses christened a unit, they also created it, whereas the Paris congress of 1900 christened two units without creating them. In other words, they christened the offspring of their predecessors.

The British Association originally called into existence a system of units which has since been adopted all over the scientific world; namely, the C. G. S. system, in which the unit of length is the centimeter, the unit of mass the gramme, and the unit of time the mean solar second. When the electrical units were evaluated in this system they were found to possess awkward dimensions, that is to say, the units were either too large or too small for practical use. For example, it required a hundred million of the electromagnetic units of e. m. f. to approximate to the e. m. f. of an ordinary voltaic cell. It likewise required some thousands of millions of the electromagnetic units of resistance to equal the resistance of a mile of ordinary telegraph wire. At that time those were the two most important electrical units, and, therefore, the most important quantities to make suitable for practical electricians. Consequently, the first electrical congress was determined to modify the units so as to give units of e. m. f. and resistance which would conveniently fit voltaic cells and miles of wire, respectively. In order to produce units in the required sizes, the congress virtually created a new system of units belonging to the what may be called the Q. E. S. system, in which the unit of length is the quadrant of the earth or 10,000 kilometers, the unit of mass the eleventh-gramme or 10^{-11} gramme, and the unit of time the mean solar second. The ratios of the various units in this system to the corresponding units in the C. G. S. system, were all decimals, or powers of 10, but varying powers of 10. Thus the practical or Q. E. S. unit of resistance or ohm was 10^{9} C. G. S. units, the Q. E. S. unit of current capacity or ampere 10^{-1} C. G. S. units, and so on.

The practical or Q. E. S. units had not long been in existence before it was found that the simple sizes of the volt and ohm could not be retained in other units, as, for example, the unit of capacity, which in the Q. E. S. system was about a million times too large for ordinary work, so that the practical condenser had to be called a micro-farad instead of a farad. Moreover, the rising pressures employed in modern electric power transmission would probably make a unit of e. m. f. a thousand times as large as a volt, quite as convenient as the volt itself, or a unit of current a hundred times greater than the ampere, just as convenient as the ampere itself. All this goes to show that it was a blunder to have attempted adapting the C. G. S. system for practical work, by creating a new or Q. E. S. system as a medium of exchange. The correct step would undoubtedly have been to christen the units of the C. G. S. system, and adopt in connection therewith a coherent system of multiples and sub-multiples like milli, mega and micro, so that just as the micro-farad serves as the practical unit of capacity, while retaining its reference to the farad as origin, so the values required for practical purposes in the various units of resistance, current, etc., should have been readily found and described in terms of C. G. S. units and of their multiple prefixes. Of course, it is easy now to look back and see what might have been done, but considered from the standpoint of the workers in the early international congresses, there can be nothing but praise for their endeavors, however much we may at the present time, regret their course of action.

As time has gone by, the C. G. S. system and the Q. E. S. system have been driven side by side like a pair of unmatched horses. The C. G. S. system could not be dropped, because it was the fundamental scientific system embracing all sciences of which electromagnetics were but a part. The Q. E. S. system could not be dropped, because the electrical units were all christened in this system and had come into extensive use. Every electrical engineer is compelled to learn both systems, and to practice one while he theorizes in the other. Every successive electrical congress that introduced a new unit necessarily defined that unit in the Q. E. S. system in order to be consistent with the acts of prior congresses, and yet the connection between the two systems was perplexing, artificial and difficult to remember. Matters continued, however, in this ill-assorted scheme until magnetics required practical recognition. The natural course to follow in the naming of magnetic units was to create and christen Q. E. S. magnetic units. The values of these units was, of course, known in advance, but their existence had never been officially recognized. The difficulty arose, however, that magnetic densities involved the introduction of a unit of area, in such a manner, for example, as lines-of-force-per-unit-of-area. In order to be consistent, and to keep the electromagnetic equations clear of meaningless coefficients, it would be necessary in the Q. E. S. system to express magnetic densities as Q. E. S. units of flux-per-square-earth-quadrant, just as the C. G. S. system naturally introduces C. G. S. units of flux-per-square-centimeter. Here the inadaptability of the Q. E. S. system became apparent, because no practical man would express lengths in quadrants or areas in square quadrants, and the Q. E. S. system may be said to have failed to be extended by virtue of its own weight of inadaptability.

Nevertheless, the dilemma existed that both the C. G. S. unit of flux and the C. G. S. unit of magnetic density were in extended use among electrical engineers, either without any authorized names or with misleading names. With this evidence in view the Paris congress of 1900 adopted the name "maxwell" for the C. G. S. unit of flux in place of the common but ambiguous phrase "line of force"; and the name "gauss" for the C. G. S. unit of flux density, as representing a maxwell-per-square-centimeter, or a line-of-force-per-square-centimeter. It is important that these terms should be used by engineers as far as possible, because they are brief, consistent and definite; while they mark a return towards the simple C. G. S. system and a renunciation of the hopeless Q. E. S. system in the magnetic department. For the first time, in 1900, an electrical congress gave names to C. G. S. units already existing, and did not burden the literature of magnetics and the memories of students with the creation of new units in the perplexing Q. E. S. system. It is, therefore, officially correct to speak of a bipolar dynamo armature, for example, as revolving in a flux of, say, 2,000,000 maxwells, or 2 megamaxwells, and of having a density in the armature teeth of, say, 15,000 gausses or 15 kilogausses. No small incentive to the immediate general use of these terms in this country should be that the American Institute of Electrical Engineers originated and advocated the plan to name the magnetic units. The action taken at Paris was on a proposal submitted by the American body, and the successful issue was largely due to the able and determined advocacy of the A. I. E. E. programme by American delegates to the congress—notably, Messrs. Kennelly and Mailloux.

Telephony in New York City.

A hearing was given at Washington on June 15 before the Industrial Commission on the subject of telephony, when Mr. U. N. Bethell, general manager of the New York Telephone Company, appeared as a witness and made a long and interesting statement in regard to the telephone conditions in New York City. The hearing lasted not less than five hours and the members of the Commission showed themselves deeply interested in the points which were brought to their consideration.

Mr. Bethell divided telephonic development in New York City into two periods, one of about sixteen years, from 1877 to 1894, and the second from 1894 to 1901. At the end of the first period the Bell system, then operated by the Metropolitan Telephone & Telegraph Company, which has since become the New York Telephone Company, had reached a total of 11,600 subscribers. In the second period 51,000 additional subscribers had been secured, making a total at the present time of about 62,600. Of the number no fewer than 37,500 had been added in the last three years, and it was Mr. Bethell's belief that at the end of the current year the system would include in the Boroughs of Manhattan and the Bronx not far short of 75,000 stations.

As to rates, telephonic development might also be divided in New York City into two periods which would coincide with those already given. The first period was that of the flat rate system. During part of the time the rate had been from $60 to $120 a year, with overhead wires and grounded circuits. The latter part of the period had seen the substitution of underground wires and metallic circuits, and the cost had necessarily gone up to rates ranging between $120 and $240 a year. There had never been, however, a period when all the rates were on the higher scale noted, because the second development, that of the measured message rate system, overlapped the earlier. In throwing out its overhead system the company had sacrificed a plant worth not less than $1,500,000, and within the last few years, carrying out its progressive development, the company, in substituting a common battery system for that with the battery at every subscriber's station, had replaced equipment sufficient to serve no fewer than 30,000 stations. This again wiped out an enormous amount of investment, but had been done readily with the aim of improving the service to the subscriber. The notable gain in enrolled subscribers was due, therefore, to three conditions: improved efficiency, the reduction in rates and the growing recognition of the value of the telephone by the public.

As to the average cost of telephone service to the public under the message rate, Mr. Bethell stated that even including the $240 stations, of which there are now somewhat less than 1400, the cost or yield per year per station was only $85. This did not include pay stations, of which the company had now installed some 4000 in New York. The cost per Manhattan message at these stations was 10 cents, of which the company received 8 cents. Forming part of the general system there are over 1200 private branch exchanges in the city connecting with the central exchanges through independent boards and ranging in capacity from 2 up to 180 stations. Mr. Bethell explained the details of the message rate system, showing how subscribers were able to increase the amount of telephone traffic done with a diminishing scale of cost upon it, down to only three cents per message.

As to rapidity in operating, he stated that an investigation of the records carefully compiled for years past, and particularly with reference to the last 18 months, showed that the average time between the subscriber's call and the operator's answer was only from three to five seconds; in only one month had it gone over five seconds, and then for but a fraction of a second. The message rate business had seen its highest development in New York City as a scientific plan of charging, and had been indorsed and approved by a committee of the New York State Legislature, by a Parliamentary Committee of the English House of Commons, by the Danish and German Parliaments, by the officers directing the municipal system of Amsterdam; by the Swiss Government, and by the General Telephone Company at Stockholm, Sweden, which operates under the message rate, while the competing government system does a business at the flat rate only. The best results, however, were obtained in the United States, and the satisfaction which they yielded in New York City was apparently shown by the fact that efforts to deal with telephony by legislative measures had virtually ceased. In bygone years, several bodies and individual citizens, prompted in most cases by the best of motives, had sought to reduce the flat rate, but since the flat rate had virtually passed out of existence attempts at legislative remedial measures had ceased, so that so far as Mr. Bethell was aware, during the last two years not a single association nor a single subscriber had gone to the New York State Legislature seeking to regulate or change the company's system of charging for its service.

On the point of dissatisfaction, Mr. Bethell said that there were generally two causes for it; one was an erroneous idea as to the profits and the other was misinformation as to conditions elsewhere, especially abroad. With respect to the profits of the business, Mr. Bethell pointed out that a legislative committee in New York State, reporting in 1888, had placed on record the fact that the abandonment of the overhead plant of the New York system would entail a loss equal to three-fifths of its net earnings from the date of its organization; that is, three-fifths of the surplus would be wiped out to take care of that particular depreciation in its property. The committee then presented figures, which, taking this loss into account, showed that the net earnings on the investment for the seven years covered by the report amounted to only 9.66 per cent per year. From 1888 there followed a long period of reconstruction, during which no dividends were paid. Since 1896, said Mr. Bethell, dividends had been paid at the rate of 6 per cent per annum. Even more significant was the fact that the percentage of cost of operation to earnings had averaged about 65 per cent; for the first four months of 1901, being 65.3. This indicated a conservative management, and with any high percentage the business would not be profitable, nor would it be possible to get capital raised to meet the public demands for an extension of the business.

Mr. Bethell went into the matter of wages and care of employees and showed that the company had not only dealt liberally with its staff, but had taken every means to ensure the comfort and health of those engaged in its different exchanges. It was, however, particularly in regard to foreign telephone work that misinformation was rife and was difficult to correct. There was extreme difficulty in comparing the results from different places, for the reason that no common denominator could be found. Mr. Bethell, from the results of his own numerous trips abroad to study telephonic conditions, was able to present a large mass of information in regard to England, France, Belgium, Germany, Switzerland, Holland, Austria-Hungary, Sweden, Norway, etc. In regard to these countries he pointed out that in France, Belgium, Germany, Switzerland and Austria-Hungary the telephone service was in the hands of the government. In Holland, as at Amsterdam and Rotterdam, the telephone system was handled by the municipality. In England the system was handled by private enterprise, but was handicapped by government royalties and interference, and by municipal obstruction, as at Glasgow and in London. In the Scandinavian countries, the rapid development of the art had been due to private initiative, as it was not subject to government restrictions until recently. The order of development and progress ran closely along this line. The telephonic systems were best under private ownership, as in this country, and worst under government and municipal ownership. The development at Amsterdam, for example, was the smallest amongst European and American cities of over 200,000, excepting Brussels and Budapest—government plants—and the two Russian cities of Moscow and Warsaw. As to the results of government ownership, Mr. Bethell pointed out that the last figures from Switzerland showed telephone receipts of 5,035,056 francs and expenditures of 6,274,015 francs. In all these cases, however, Mr. Bethell did not find fault with the technical bureaus, but attributed the poor showing to the political conditions which always surround such work even in the best governed countries.

Another Large Gift to the A. I. E. E. Library.

Mr. Andrew Carnegie has donated to the American Institute of Electrical Engineers the sum of $6,880.28, to be expended in housing, cataloging and completing the Latimer Clark collection of electrical books recently presented to the Institute by Dr. S. S. Wheeler.

It was the original intention of Mr. Carnegie to purchase the Latimer Clark collection for the Institute. Upon being informed, however, that Dr. Wheeler, feeling that delay might cause the library to be lost to the Institute, had stepped in and purchased it direct from the Latimer Clark heirs, Mr. Carnegie very generously offered to donated a sum equal to that paid by Dr. Wheeler, in order that the library might be properly housed and cataloged and rendered more complete.

The Largest Electrically Operated Dry Dock in the World.

WHILE it seems almost incredible that the port of New York, the most important of the Western Hemisphere, should have been until very recently without proper commercial dry dock facilities for the accommodation of large transatlantic steamers, it is nevertheless a fact. Heretofore it has been found necessary, in case any accident happened to the hull of one of the recently constructed floating monsters on its westward passage, to take it to one

FIG. 1.—GENERAL VIEW OF DOCKS.

of the ports outside of New York for repairs, or in emergencies obtain permission to dock at the Navy Yard.

This reproach, however, no longer rests upon the port of New York, for there has recently been completed what is claimed to be the largest and most efficient floating dry dock in the world. It was designed by and constructed for the Morse Iron Works & Dry Dock Company, and is located near the new 40-ft. channel, now being dredged along the South Brooklyn shore. The dry dock itself is situated at the foot of Fifty-sixth Street, the property of the company extending from Fifty-fifth to Fifty-eighth Streets, and including land under water reaching some 2000 ft. into the harbor. A view of the company's property, comprising the dry dock, several basins, a marine railway, large ship building, repair and machine shops, the transformer house, etc., is shown in Figs. 1 and 3.

The floating dry dock, which at present consists of five sections, or pontoons, each 80 ft. in length, has a total length of nearly 500 ft., which includes the 4-ft. spaces between the pontoons and the 36-ft. extensions at each end. When completed, the dry dock will be between 700 and 800 ft. in length, capable of accommodating with ease the largest ship afloat. The pontoons are 120 ft. in width, and the combined lifting capacity of the pontoons at present installed is 15,000 tons.

Aside from the fact the dock is the largest and most powerful floating dry dock in the world, it is remarkable on account of the novel methods employed for the operation of its pumps and the

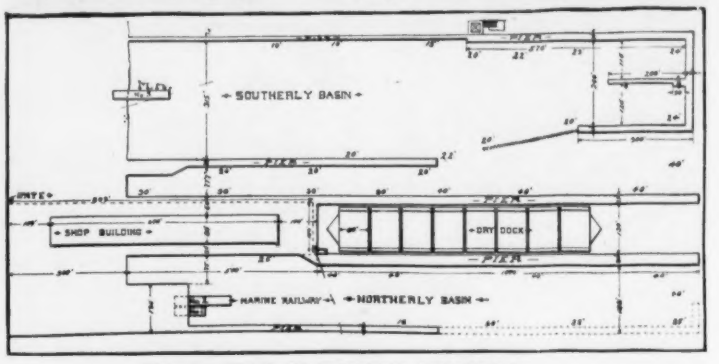


FIG. 3.—PLAN OF PROPERTY AND PIERS.

kind of machinery installed. The power used is electricity, the motors being of the induction type, and the pumps are of the centrifugal pattern. An idea of the efficiency of the arrangement may be gathered from the fact that it is possible to dry dock an 8000-ton ship in about 40 minutes time. Recently the Mt. Vernon, a 649-ton ship, was lifted in 25 minutes, and it took only 51 minutes to dock the California, a 9000-ton vessel, shown in one of the illustrations (Fig. 2.)

As will be seen from the illustrations, each pontoon or section has the shape of a V. As stated above, each section is 80 ft. long by 120 ft. wide, and has a depth of 15½ ft. at the center. The two wings at each side measure 56 ft. from the bottom of the pontoon to the top platform, on which the motors and handwheels for the inlet valves are located. The sections are built of the best Southern pine, and a complete system of stiffening bulkheads is used, there

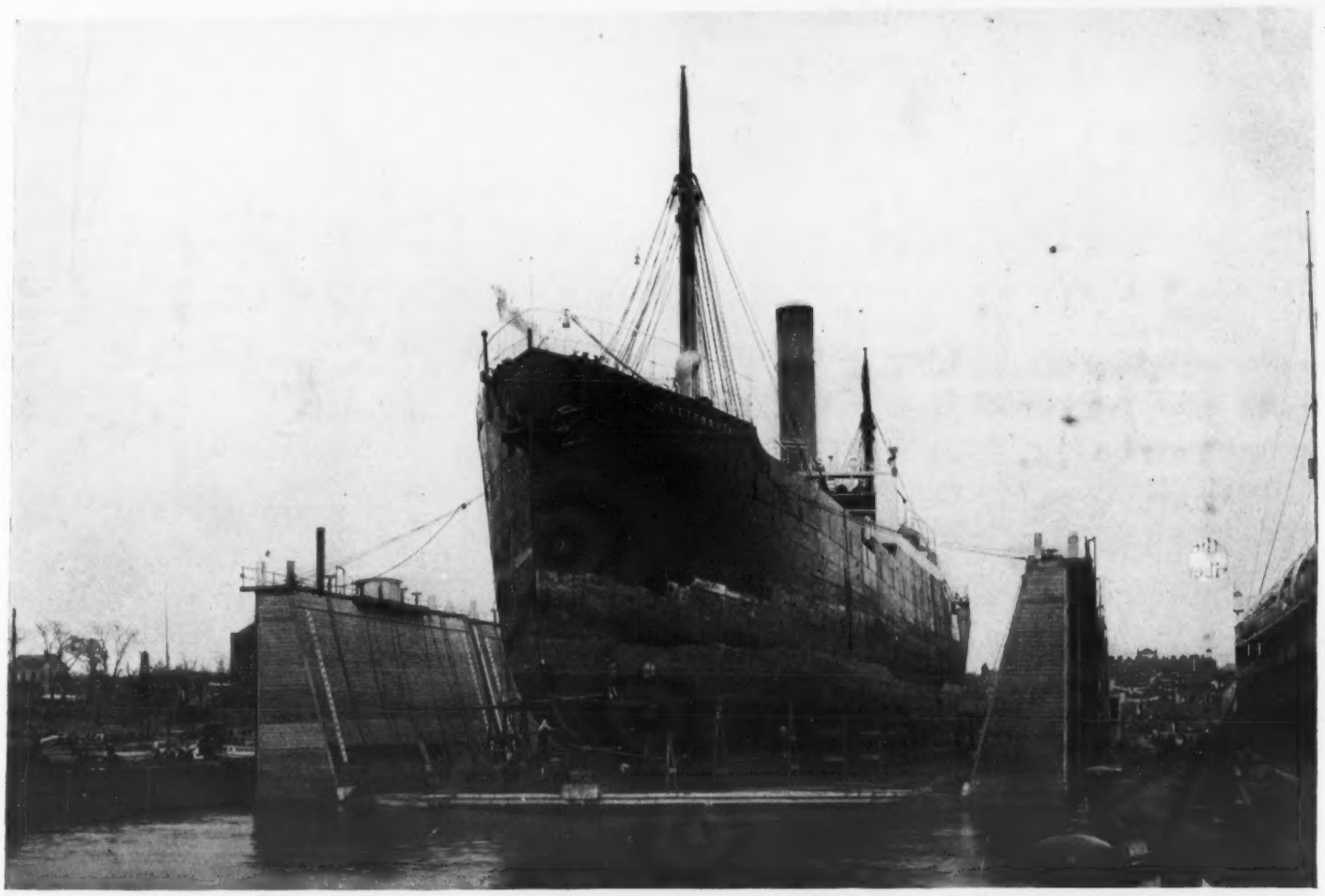


FIG. 2.—STEAMSHIP ON ELECTRIC DRY DOCK, SOUTH BROOKLYN, N. Y.

being seven running longitudinally, or fore and aft, through each pontoon. Each section is provided with a number of inlet gates below the water line, and sufficient ballast is carried to insure its sinking when the gates are opened.

On the floor of each wing is situated a centrifugal pump, manufactured especially for this dock, by the Prindle Pump Company. Each pump is supplied with three suction pipes, two extending towards the two end chambers and one to draw the water out of the central one. There are in all six compartments, three on each side of the main central bulkhead; but in case of a breakdown, the two sets of compartments may be connected by means of sluice valves, and either pump can accomplish the entire task of pumping out the pontoon. This sectional arrangement makes it possible to dock a vessel which is considerably listed, by tilting the dock, which has hitherto been found to be an impossibility. After the pontoon has assumed the same angle as the listed vessel, the latter is secured on the dock, which is then made to assume a level position. The pumps have a capacity of 5000 to 6000 gallons of water per minute and all suction pipes are 20 inches in diameter.

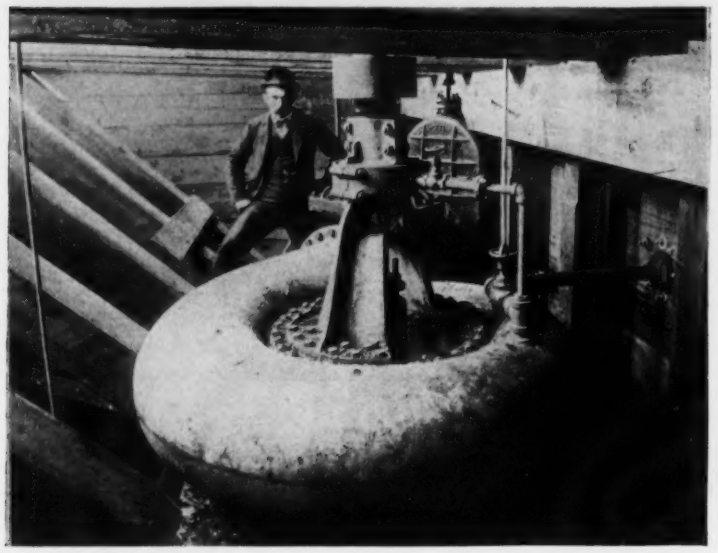


FIG. 4.—CENTRIFUGAL PUMP DRIVEN BY INDUCTION MOTOR.

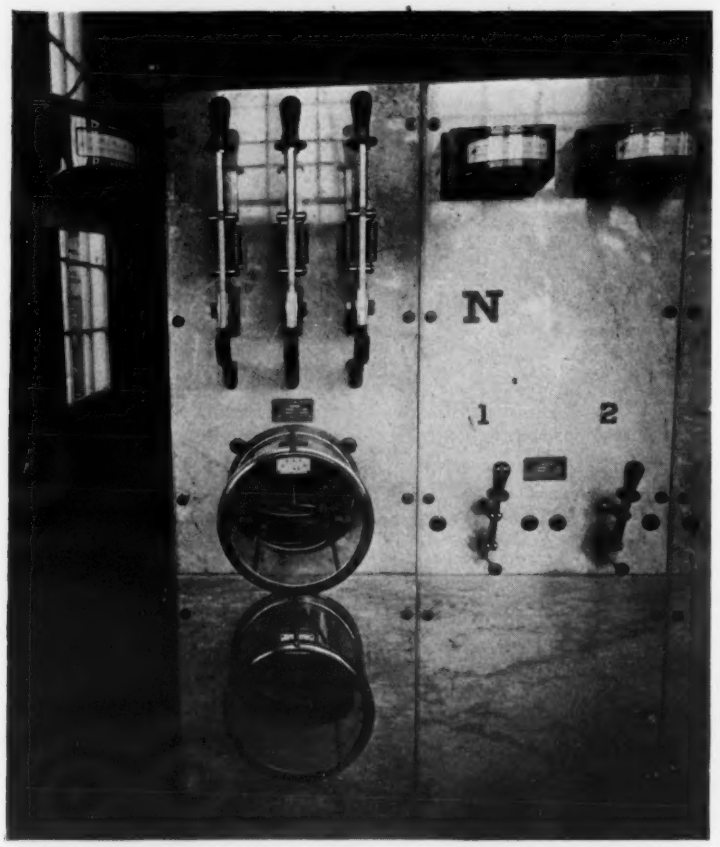


FIG. 5.—MAIN SWITCHBOARD PANEL.

Each pump is connected by means of a vertical shaft to a 75-hp General Electric induction motor, which is carefully housed in at the top of the pontoon, more than 50 ft. above the pump. Three-phase current at 6600 volts and 25 cycles to operate these motors is supplied to the company by the Edison Electric Illuminating Company, of Brooklyn. It is led to three 300-kw General Electric air-blast transformers, connected up in delta, located in a transformer house, where it is transformed down to 240 volts. A 2-hp induction motor is directly connected to a Buffalo Forge Company's blower, which supplies the air for cooling the transformers. A duplicate set of three conductor cables has been installed to guard against a breakdown.

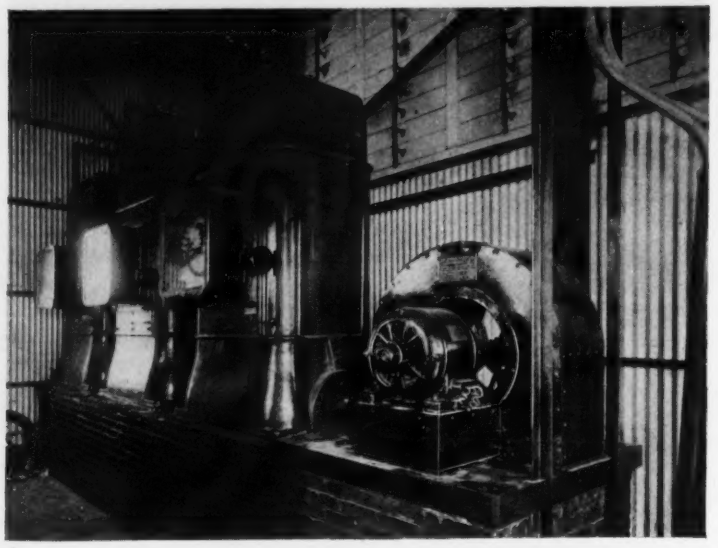


FIG. 6.—AIR COOLED TRANSFORMERS.

From the transformers the current is led to the switchboard, consisting of 6 panels, 5 of which are for the control of the motors. On one panel are mounted the polyphase wattmeters, one for the starting bus, at 140 volts, and one for the main bus, at 240 volts, as well as three 3000-ampere single-pole quick-break knife switches for controlling the board. The voltmeter is mounted on a swinging bracket. On each of the five motor panels, each of which controls two 75-hp induction motors, are mounted two three-pole double-throw oil switches, and two Thomson alternating-current ammeters, reading from 0 to 350 amperes. The wattmeter panel and one of the motor panels are shown in Fig. 5.

On the back of the board are two sets of bus-bars, the lower ones being the starting and the upper ones the main busses. There are also two G. E. circuit breakers which control the starting busses. The main wattmeters are supplied with current transformers, which can carry a normal load of 2300 amperes and an overload of 3500 amperes for 30 minutes, the ratio being 140 to 1. The transformers for the starting wattmeters are designed for a normal load of 1200 amperes and a 30-minute overload of 2000 amperes, the ratio being 80 to 1. The motors on the pontoons are controlled entirely from this

FIG. 7.—VIEW SHOWING METHOD OF SUPPORTING CABLES.

board, and after the motors have attained their proper speed, which the operator judges from the noise in the transformers ceasing, he throws them from the starting busses onto the main busses. The motors drive the pumps at a speed of 250 r. p. m.

The Edison Company also furnishes two-phase, 60-cycle, 2500-volt current for the lighting of the dock, which is done by means of arc lamps, located on the top platforms. The current is led to these lamps by means of flexible cables, supported in elevator loop fashion, as shown in the illustration.

The mode of procedure followed in docking a vessel is as follows: The inlet gates are opened and the pontoon sunk to a depth which will allow the vessel to be backed in between the wings, with the necessary clearance between her keel and the keel blocks. As soon as everything is in position, the pumps are started simultaneously,

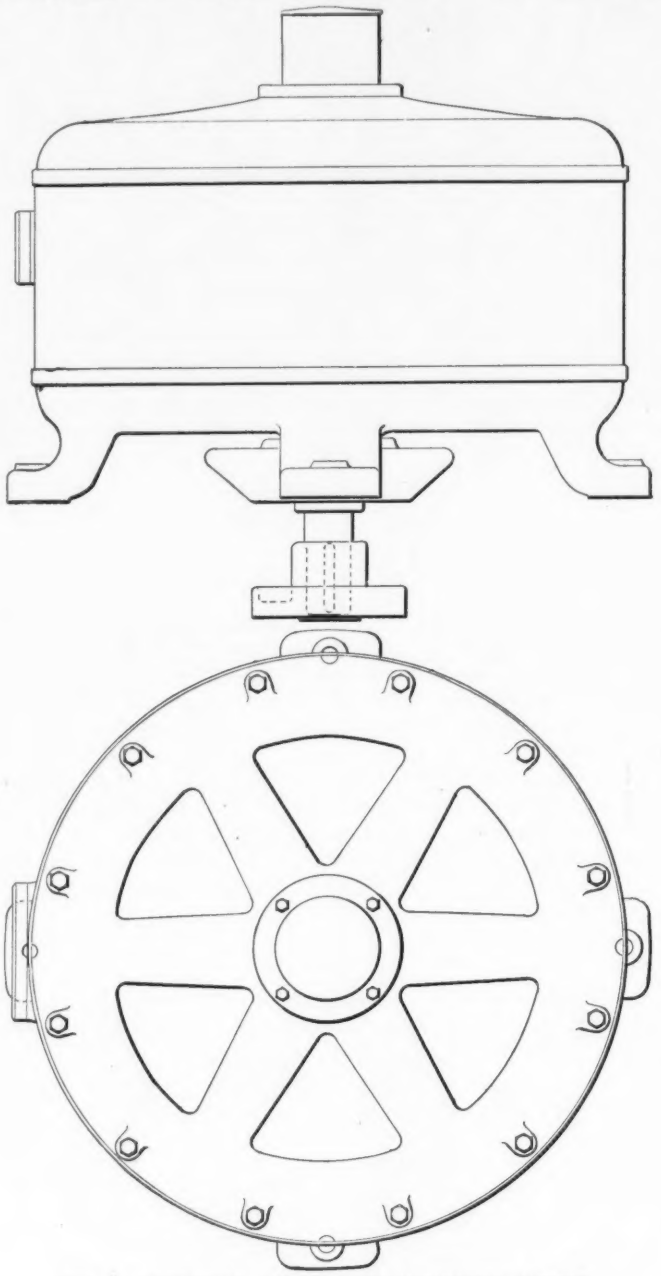


FIG. 8.—ELEVATION AND PLAN OF INDUCTION MOTORS.

in case the vessel has no appreciable list, from the switchboard in the transformer house. As the water is pumped out the pontoons will rise, lifting the vessel clear out of the water. One advantage of this sectional building of a dock is that only so much of the dock need be used as is desired. For example, a vessel that is only 150 ft. long would simply require the pumping out of the first two sections.

It should be stated that the electrical method employed here is one which has never been used before, and has been found to be extremely flexible and efficient. Great credit is due to the various companies who have combined forces to make this plant a success, and special mention should be made of Mr. E. L. Etheridge, the Morse Company's electrical engineer, who has devised many important features. Mr. E. P. Morse is president and treasurer and Mr. Charles G. Street secretary of this enterprising and growing establishment.

Some Notes on Dielectric Losses

BY CHARLES PROTEUS STEINMETZ.

IN the following are given the results of some determinations of the loss of power in electrostatic condensers on an alternating-current circuit, and at various frequencies and voltages. The condensers consisted of tinfoil and paraffined paper, filled with paraffine by the application of heat and vacuum, so as to exclude the air as far as possible.[1]

Anticipating a loss of power of a fraction of 1 per cent of the volt-amperes apparent input, I did not consider it feasible to measure directly the power by wattmeter, for the following reasons:

1. Even with a voltage and a current greatly overloading the wattmeter, the reading of the instrument is at or below the lower end of the scale, being only about ½ per cent of the volt-amperes impressed upon the instrument.

2. The inductance of the potential coil and the capacity of its series resistance cannot be determined with such accuracy as to derive the phase angle of the potential circuit of the instrument with sufficient closeness to avoid an excessive instrument error when testing a circuit of about 89.7° per cent phase displacement.

Therefore, I devised the following method, which proved very satisfactory:

1. An inductance coil of extremely low power factor (from ⅓ to ¾ per cent, according to the frequency), and of a reactance equal to the capacity reactance of the condensers, was shunted thereon, so that the lagging current of the inductance and the leading current of the condensers compensated, and a small resultant current of practically no-phase displacement remained. Then the wattmeter could be used to read very accurately the total power consumed in the condensers and inductance coil. The power consumed in the inductance coil was determined by measuring volts and amperes with direct current passing therein, and subtracting from the wattmeter readings.

2. The test was repeated with the inductance coil in series with the condensers. In this case the wattless leading voltage of the inductance and the lagging voltage of the condensers compensated, and the small resultant voltage is practically in phase with the current.

In either case a non-inductive resistance, very large compared with the capacity reactance of the condenser, was inserted in series, to eliminate higher harmonics of current,[2] and a smooth core armature alternator was used, giving practically a sine wave.

Since the correctness of this method depends upon the absence of other losses in the inductance coil than ohmic losses, the coil was built without iron to exclude hysteresis losses, was of very large diameter, and of well stranded cable to exclude eddy currents in the conductors—the absence of eddy currents being checked by tests.[3]

From 7 to 35 blocks of condenser were used, and the tests extended over a range of voltage from 220 to 980, for parallel as well as series connection of condenser and inductance coil. The average results of tests are given in the accompanying table per block of condenser. They are essentially:

1. With a sine wave of impressed e. m. f. the current in the condenser is directly proportional to the impressed e. m. f. and to the frequency; that is, the capacity of the condenser on an alternating current circuit is constant, within the range of tests.

2. The loss of power in the condenser is, within the range of tests, proportional to the square of the impressed e. m. f.; that is, the power factor of the condenser, at constant frequency, is constant and independent of the impressed voltage. (If anything, the loss rather appears proportional to a little higher power of the e. m. f. than the second.)

3. The power factor of the condenser does not seem to vary with the frequency; that is, the efficiency of the condenser appears to be independent of the frequency: or in other words, the loss of energy per cycle is proportional to the square of the electrostatic field

[1] The condensers were standard 500-volt General Electric condensers, taken from stock, and after each set of tests returned thereto, so that the tests with different frequencies are not directly comparable.

[2] With no resistance in series to the condenser, even with an almost perfect sine wave of e. m. f., it is quite common to find the condenser current several times larger than corresponds to the capacity, since very high harmonics, which are too small to be detected in the e. m. f. wave, may produce excessive currents in the condenser. For instance, a 19th harmonic of e. m. f. of 2 per cent, with a transformer of 4 per cent inductance, gives in the condenser a 19th harmonic of current of over one-half the amplitude of the fundamental.

[3] For this purpose two stranded conductors were wound in multiple, connected in series for the condenser tests and in opposition for the check tests. In the latter case the eddy currents in the conductor obviously are the same, but since, due to the absence of an external field, the coil is practically non-inductive, the loss could be measured with alternating current by wattmeter, and checked with the ohmic loss determined by direct current.

strength, but independent of the frequency, as far as can be seen, considering that different lots of condensers were used in the different tests and the loss of power varied considerably in different sets of condensers.

4. The power factor of well-made condensers is extremely low, averaging about .005, or the efficiency is about 99.5.

Let n = frequency.

I = current, and W = loss of power, per block of condensers, at difference of potential E.

We then have

$$I = a\,n\,E\,10^{-6}$$
$$W = h\,n\,E^2\,10^{-9}$$

Power factor $f = \frac{h}{a}\,10^{-3}$

n	57.	77.3	93.9	114.	133.	Avg.
a	15.61	15.59	15.55	15.57	15.60	15.59
k	58.5	86.	105.	102.5	67.5	83.9
f (per cent)	.375	.551	.675	.659	.433	.539

The efficiency, therefore, varied between 99.625 per cent and 99.325 per cent, and the condenser is thus one of the most efficient pieces of apparatus known.

As regard the existence of a true dielectric hysteresis, while I believe such a phenomenon exists, I am under the impression that at least a very large part of the observed loss is not due to hysteresis, but is due to traces of air which are still occluded in the dielectric of the condenser; and caused by mechanical motion of the air molecules under the influence of the alternating electrostatic stress.

Self-Starting Single-Phase Motor without Brushes.

By J. Fischer-Hinnen.

If one considers the field of an ordinary direct-current machine, shown in Fig. 1, as composed of insulated pieces of sheet iron, and the brushes moved out of the neutral zone and connected with an alternating-current source, then this motor, although it has no magnet coils of its own, will start to revolve in the direction in which the brushes were moved out of the neutral zone. As will be seen, no magnet coils are necessary if there are a sufficient number of armature coils, since the requisite field will be produced by the ampere-turns of the armature wires between *ab* and *cd*, and the maximum turning moment is obtained when the brushes are placed in the position indicated by *ac*, close to the pole-tips.

Such a motor possesses all the properties of an ordinary series direct-current motor—that is, large starting torque, the dependence of the speed on the load, and the property of regulating the speed. By choosing the proper proportions, a cos may be obtained which is far in excess of the cos which may be obtained with an ordinary asynchronous single-phase motor, but the objection to its practical application is the large amount of sparkling at the collector.

This fact induced me to effect the current distribution in the armature required for starting, not by means of any special position of the brushes, but by means of induction, doing away entirely with the brushes. Although I applied for a patent on this over five years ago (Swiss patent No. 13,651, of Dec. 17, 1896), I had only an opportunity recently to build a small motor of this type, and a description of the same may be of interest, as no details of the motor have ever been published.

"Figs. 2*a* and 2*b* show diagrammatically the connections of a bipolar motor. Accurately speaking, it consists of two separate motors with a common armature winding. To simplify the conception, the armature is assumed in Fig. 2 as a short-circuited armature, although the torque is thereby reduced to a certain extent. A phase armature (that is, one in which the phases are kept separate) would be better adapted for this purpose."

The magnet poles are turned with respect to each other through an angle of 45 degs., or in general through $\frac{90}{p}$, in which p is the number of poles. Instead of this the armatures might be turned through the same number of degrees, as is shown, for example, in Fig. 3.

The starting of the motor is accomplished by first sending the

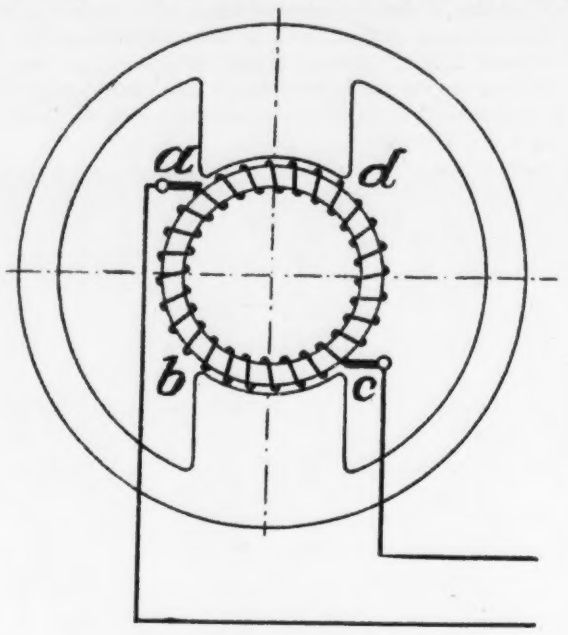


FIG. 1.—FIELD OF DIRECT-CURRENT MACHINE.

current through one of the two windings, while the other is switched out by hand. If we assume, for example, that the magnet winding

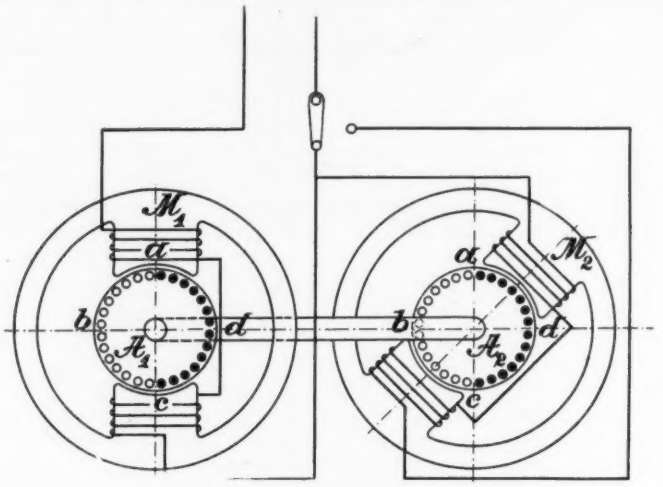


FIG. 2A.—DIAGRAM OF CONNECTIONS.

M is switched in, then this winding acts with respect to the armature winding A, as the primary of a transformer does to the secondary;

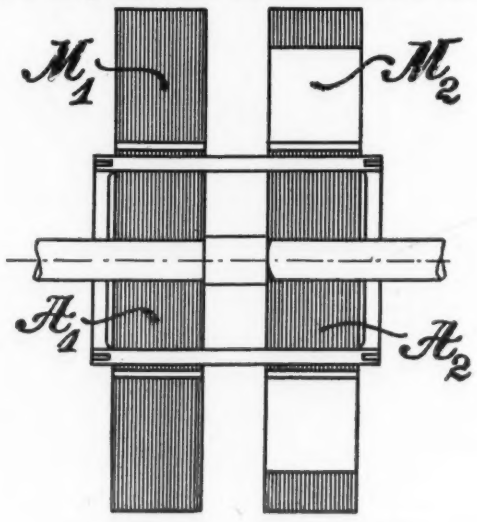


FIG. 2B.—DIAGRAM OF CONNECTIONS.

that is, the current is produced in the armature A_1, the magnetic axis of which coincides with that of the field M_1. The same current

distribution also takes place in armature A_2, as the two armatures have a common winding. The wires located between *a b* and *c d* therefore produce lines of force which pass through the field M_2 and create a turning moment in the wires *a d* and *b c* of about the same phase. When the motor has attained a certain speed the winding M_2 is switched in. The motor then becomes an ordinary asynchronous machine, and has a nearly constant speed at any load.

I wish to take this opportunity to point out an interesting peculiarity of the motor. If the field M_1 is switched in first, the motor will turn to the right and keep on turning in this direction after the winding M_2 has been switched in. If, however, one proceeds in the reverse order by first sending the current through the

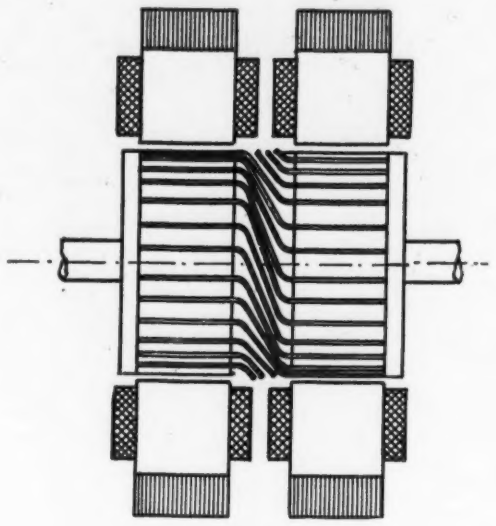


FIG. 3.

winding M_2, and only through M_1 after the motor has started, the motor will run in the opposite direction. It is therefore possible to make the motor revolve in either direction.

On account of its low cost the motor is well adapted for domestic purposes, such as the operation of sewing machines, fans, etc. For heavier work it is perhaps better to employ two separate motors with collector rings, and use rotating magnets, so as to reduce the number of rings. Besides, the same principle might, under certain conditions, be utilized for alternating-current arc lamps, wattmeters, etc., by using a disk armature instead of the ordinary armature in order to reduce the friction.

In this case the field necessary for starting is obtained by tilting the magnet poles. The same thing could be accomplished, however,

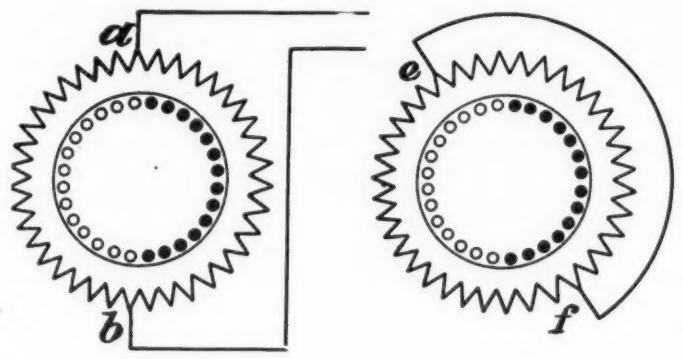


FIG. 4.

by choking the secondary field in a certain direction, as shown in Fig. 4, by short circuiting the winding M_2 at two points, *e* and *f*, situated opposite each other and moved $\frac{90}{p}$ degs., with respect to the magnetic axis of the field M_1. The effect in this case will probably not be as perfect, because a small stray field will be present, the direction *e f*, which will cause an uneven turning moment.

But whatever method may be chosen, it is of importance that the slots be entirely closed. When using the method shown in Fig. 2 the pole tips must be well rounded and the number of armature teeth must be so chosen that no sparking can be produced.

Los Angeles Transmission Plants.

LOS ANGELES is now the most important power transmission center in the West. To be sure, it will soon be called on to divide its honors in this respect with San Francisco and Oakland, but at the present time it probably stands at the head as being the chief city in a district which has done more pioneer transmission work than any other in the United States. This is not said to the discredit of the transmission work done at many other Western points, which have all played an important part in the development of the art of long-distance electric transmission.

There are two companies operating long-distance transmission lines into Los Angeles, the Edison Electric Company (purchaser of the Southern California Power Company) and the San Gabriel Electric Company. There are also three other companies operating long-distance transmission lines within a radius of 80 miles of Los Angeles, the Redlands Electric Light & Power Company, the San Bernardino Electric Company and the United Electric Gas & Power Company, of Santa Monica, so that there is a belt 100 miles long east and west and 30 miles wide north and south in Southern California, which is pretty thoroughly covered with high-tension lines. At times a number of these plants in this district have been operated in parallel with each other, thereby securing the maximum reliability and immunity from breakdowns for all concerned. Of this more will be said later.

The present article will deal mainly with the two large transmission plants supplying Los Angeles. Descriptions of them have previously appeared in the technical press, but results of operations of plants of this kind have not ceased to be of value. Both of these companies have distributed systems in Los Angeles for light and power, and also help feed the Los Angeles Railway. Both also have steam auxiliary plants at Los Angeles as the water-power plants are not sufficient to carry all the load at lowest water.

THE SAN GABRIEL ELECTRIC COMPANY

operates a 16,000-volt, 23-mile transmission line from a water-power plant near the entrance to the San Gabriel Cañon, about one mile north of Azusa, Calif. It has also recently acquired an old power plant in the San Antonio Cañon, 44 miles from Los Angeles, which will be run in connection with the San Gabriel plant.

The transmission line from the San Gabriel Cañon to Los Angeles consists of two three-phase circuits of No. 5 B. & S. medium hard-drawn copper wire on glass insulators. The Provo No. 1 type of insulator made by the Hemingray Glass Company, with an outer petticoat about 7 inches in diameter, has proved the most successful. A glass insulator previously used, having a diameter of 5½ inches, did not give satisfactory results. Most of the short circuits on the line are caused by birds. Formerly the lines have been patroled once a month, but hereafter a man will go over them once a week in connection with his attendance on some sub-stations for electric lighting acquired by the purchase of the San Antonio Electric Light & Power Company. With the newly acquired lines the company will hereafter have 100 miles of high-tension line. It has been claimed by advocates of porcelain insulators that glass will stand little mechanical abuse. The San Gabriel management points to the fact that on the old San Antonio 10,000-volt line some glass insulators were found with the petticoats entirely shot off, which had caused no short circuit. It is the practice now to coat all cross-arms and pins with a coat of asphaltum ⅛ inch thick. This is done by dipping the cross-arm with the pins on just to the point to which the insulator comes on the pin.

The power house at Azusa has four 300-kw, two-phase Westinghouse generators direct connected to Tuthill waterwheels. The exciters are belt-driven from the generator shaft. The frequency is 50, as in all transmission plants in this region. Two men are kept on duty at this power house in 12-hour shifts, making four men to operate the power house 24 hours. On the ditch and pipe line one man is employed in summer and three in winter.

At the sub-station in Los Angeles, which is close to the heart of the city, five classes of service are given—2400-volt, two-phase, a. c., power service; 24,000-volt, two-phase, a. c., lighting service; 110-volt, three-wire, d. c., lighting service; 500-volt, d. c., power service; a. c. constant-current arc lighting.

To supply so many classes of service, which were necessitated by the conditions when the company started, naturally requires a great variety of apparatus, and has given rise to a number of ingenious combinations.

Adjoining the sub-station is a steam plant which is used as an

auxiliary at time of low water during the summer. In the steam plant rope-driven two-phase Westinghouse alternators are installed. Four men run the sub-station 24 hours, working 8-hour shifts, and four men a day are kept on duty at the steam plant, where steam is kept up all the time as an emergency precaution. Los Angeles crude oil is used for fuel as in all Southern California plants.

Direct current service is supplied by rotary converters. There is one 400-kw, 250-volt rotary for the three-wire system; two 250-kw rotaries for either 500-volt power or three-wire system, and one

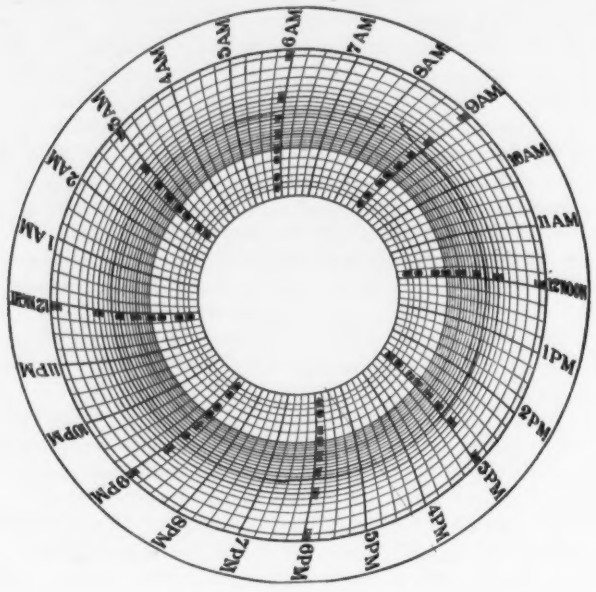


FIG. 1.—VOLTMETER CHART.

250-kw, 500-volt rotary. The 250-volt rotaries when working on the three-wire system are connected on what is commonly known as the Hartford method, which consists in connecting the direct-current terminals of the rotary converter to the outside wires of the three-wire system, and connecting the neutral wire to the middle points of the secondary transformer coils which supply the rotary. During the day when the lighting load is light, two of the 250-kw rotaries are connected in series to supply 500-volt direct current for the Los Angeles Railway along with the 500-volt rotary. There is also a sub-station at Pasadena where there is a 500-volt, 400-kw rotary supplying the Los Angeles & Pasadena Electric Railway.

All the circuit breakers at the Los Angeles sub-station are pro-

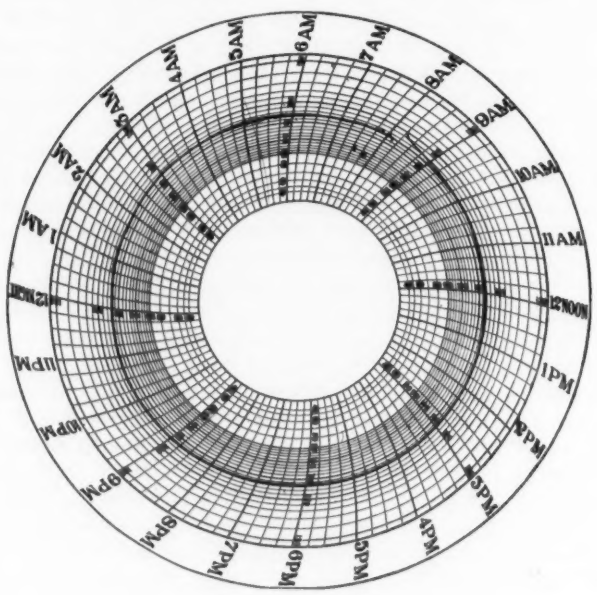


FIG. 2.—VOLTMETER CHART.

vided with auxiliary contacts, whereby in case they open from any cause the supply circuit is connected to a water rheostat to prevent a sudden throwing off of the load. This, of course, is to improve the regulation. The regulation on the lighting mains is excellent, as shown by the Bristol recording voltmeter charts shown in Figs. 1, 2 and 3. These are from an instrument connected to the lighting mains. The writer had the pleasure of looking over a large number of these in the office of General Manager Balch, and those shown are fair samples of the whole lot. The lighting service is supplied over the same transmission line as the railway and power service, but, of course, the percentage of fluctuating load to the total load is small. Lombard governors are used at the water-power plant. The sub-station switchboard attendants watch the voltage closely, and if

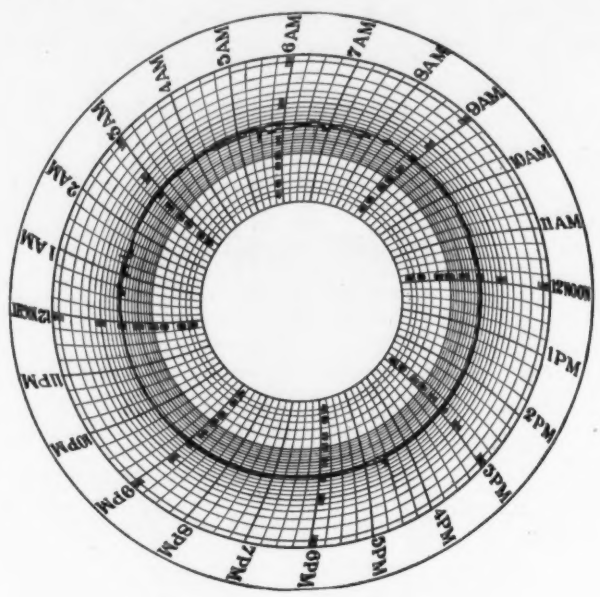


FIG. 3.—VOLTMETER CHART.

any radical changes are to be made the power house is notified by telephone.

There are no fuses on any of the lines or transformers at the power house. At the sub-station the direct-current circuits are provided with circuit breakers, and the alternating circuits are fused with aluminum wire enclosed in a tube. When the high-tension transmission lines short circuit it usually is burned off. If it does not burn off it is found by trial on which of the two lines the short exists and the other line is used alone. The underground three-wire network of the city is divided into two parts, north and south, the north set of mains being connected to the south set of mains. If a short occurs on either set of mains too heavy to be burned off only one-half the service will be shut down thereby. The lighting of the city is done by series a. c. arcs supplied from constant potential transformers. Manhattan regulators keep the current constant at 6.6 amperes. Sixty lamps are run in series with 80 volts per lamp. By using constant potential transformers for this arc-lighting service the same transformers are utilized during the day on 2400-volt power service.

Besides the four kinds of city light and power service enumerated an important part of the company's business is that of supplying power for irrigation pumping. Last summer 30 to 40 pumps of 30 to 40 horse-power were in operation. The present summer a load of 2500 horse-power is anticipated. These farmers' pumping plants are supplied from the 16,000-volt line. At a pumping station two transformers are placed, stepping down from 16,000 volts, three-phase, to two-phase for the pump motor. The rate for irrigation pumping is 1¾ cents per horse-power hour. The pumps are cut off from 5 to 9 p. m. to accommodate the lighting peak. The 2400-volt power circuit supplies five brickyards, which stop at 3 p. m., so that this also is a good thing for the load factor.

A load curve for 24 hours is shown in Fig. 4. This is from a winter day. In the summer the irrigation pumping fills up the hollows and makes the remarkably good load factor even better. The power supply to the Los Angeles Railway is cut off during the lighting peak, as the railway company has its own plant from which it can get power. The power factor of the apparent load averages 80 per cent.

This company gives special attention to checking up consumers' meters to prevent loss of revenue through slow meters so common in many places. It is the aim to check each consumer's meter in place with a stop watch every six months. Five trials of this kind are made for each meter to try the accuracy on different loads.

The following are the rates for various classes of service:

REGULAR SCHEDULE OF POWER RATES, JAN. 1, 1900.

Minimum Bill, $2.00 per month.

Discount.				Kilowatt-hours.			Net.
20 %	when	consumption	is between	25,000	and	124,000	12
40 %	"	"	"	125,000	"	249,000	9
46⅔%	"	"	"	250,000	"	499,000	8
53⅓%	"	"	"	500,000	"	749,000	7
60 %	"	"	"	750,000	"	999,000	6
66⅔%	"	"	"	1,000,000	"	1,999,000	5
73⅓%	"	"	"	2,000,000	"	over	4

REGULAR SCHEDULE OF ARC RATES, JAN. 1, 1900.

Each arc burning from sunset to 9 o'clock week nights, and until 10.30 o'clock Saturday nights; no light Sundays, per week	$1.25
Burning from sunset until 9 o'clock, each night	1.50
Burning from sunset until 10 o'clock, each night	1.75
Burning from sunset until 11 o'clock, each night	2.00
Burning from sunset until midnigt, each night	2.25
Burning from sunset until 1 o'clock each night	2.50
Burning from sunset until sunrise, each night	3.00
Burning from sunrise until sunset, each day	2.00
Burning for 24 hours each day	5.00

REGULAR SCHEDULE OF INCANDESCENT LIGHTING RATES, JAN. 1, 1900.

Base Rate, 15 cents per 1000 watt-hours.

When monthly bill is							Net.
less than			$2.00	no discount.			14c
"	"	"	between	2.10	and	$3.90	6⅔% 13c
"	"	"	"	4.05	"	9.90	13⅓% 12c
"	"	"	"	10.05	"	29.85	20 % 11c
"	"	"	"	30.00	"	49.95	26⅔% 10c
"	"	"	"	50.10	"	99.90	33⅓% 8c
"	"	"	"	100.05	"	199.95	46⅔% 6c
"	"	"	"	199.95	"	over	60 % 5c
Minimum bill, $1.00 per month, 300.00					"	over	

Minimum bill on arcs on meter, $4.00 per lamp per month.

The Company is under the general management of A. C. Balch, to whom and to Superintendent E. A. Beck the writer is indebted for much information and many courtesies shown. Mr. Balch reports the plant to be in excellent financial condition, with well satisfied stockholders. Enlargements are soon to be made.

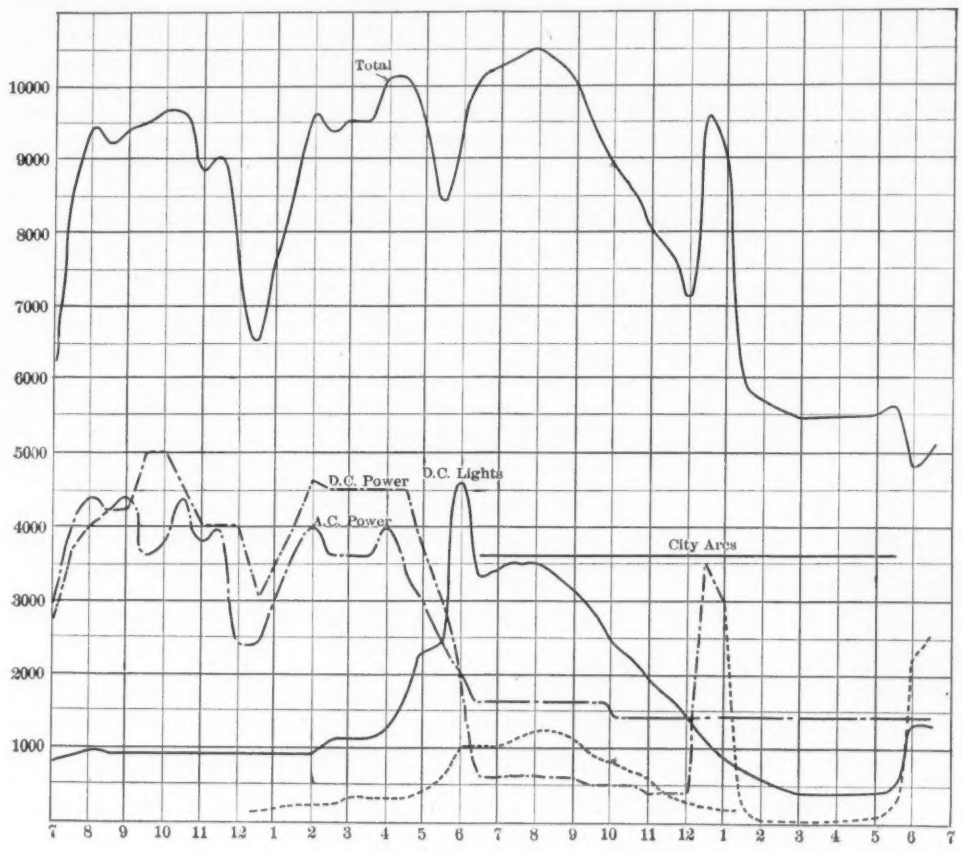


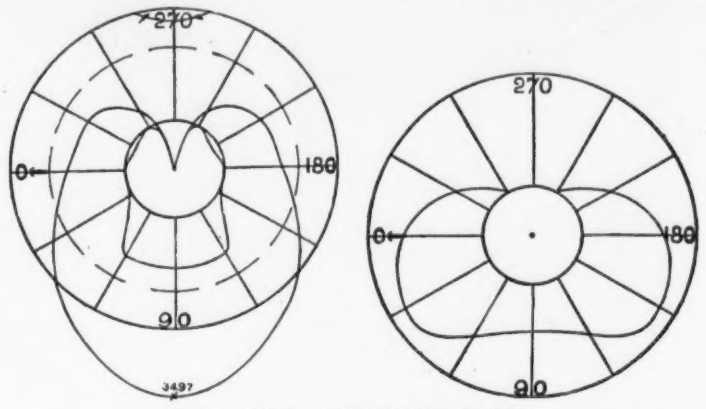
FIG. 4.—LOAD CURVES FOR FEBRUARY 13, 1901.

Elements of Illumination—XXVII.

By Dr. Louis Bell.

In spite of the trouble from dust, alluded to in the last paper, the holophane globes have come into considerable use for street lighting in some European cities, notably Munich, where several thousand have been used on Welsbach street lamps for several years past. The net result is reported to be exceedingly good, although the amount of labor involved must be, from an American standpoint, very considerable. Breakage in this case is reported at about 10 per cent per annum.

If this device could be successfully applied to arc lamps for street lighting, a very valuable redistribution of the light might be effected,



FIGS. 1 AND 2.—DISTRIBUTION CURVES.

but certain obstacles seem to be interposed on account of the shifting of the arc as the carbons are consumed. With a focusing form of lamp this trouble would be averted, but such lamps have never yet come into considerable use.

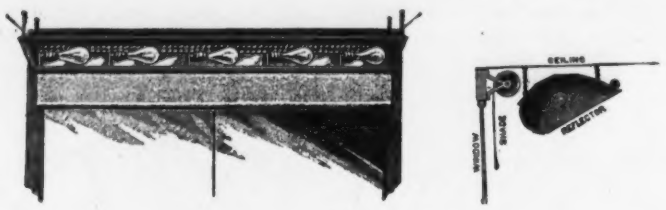
Tests of holophane globes on incandescent lamps show in a thoroughly typical manner the effect of their peculiar structure in diffusing and redistributing the light. For example, Fig. 1 exhibits the distribution produced by a holophane of the "stalactite" shape designed to throw the light downward. It does this very effectively, giving less of a spotted effect than any of the reflecting devices and at the same time diffusing the light from the bare filament very thoroughly. The light absorbed by this stalactite was only 14.6 per cent, which is considerably less than would be lost by any equally effective device for diffusion alone, to say nothing of the matter of redistribution. And this figure for absorption is probably increased by the deflection of so much light downwards, since similar shades designed to throw more light laterally give materially smaller absorption.

From a considerable number of tests the holophane shades appear to average about 12 per cent absorption when clean. That is, they actually transmit very nearly as much light as clear glass globes that have no value in redistributing or diffusing the light. As to their great usefulness in indoor work there is little doubt. For street lighting they are capable of immensely improving the distribution of the light, but the matter of keeping them clean is serious. Their greatest chance for practical usefulness would be in connection with arc lamps if the details of such an application should be thoroughly worked out.

Fig. 2 shows the distribution curve from a holophane stalactite designed to produce a more general distribution than Fig. 1, the absorption in this instance being only 10.8 per cent. The principle employed in these shades would readily lend itself to the distribution of light in special directions for special purposes, but the variety of work in which light has to be directed is so great that special problems are best treated by the use of reflectors which are comparatively cheap and can readily be adapted to any required form.

There is a vast amount of illumination which may properly be classed with scenic illumination, although it may be purely utilitarian. It is at all events directed illumination rather than that intended for the general lighting of an area. In this category fall the lighting schemes for shop windows, picture galleries, exhibits of various kinds and the thousand and one cases in which some particular object must be strongly lighted.

Of these cases many may be sufficiently well treated by placing strong lights near the objects and far enough at one side to be out of the field of view, but, as a rule, the use of reflectors is desirable.



FIGS. 3 AND 4.—WINDOW REFLECTORS.

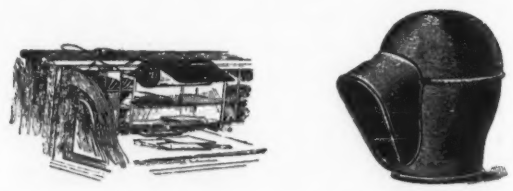
Reflectors for such work are made in various shapes and of various materials, most commonly of brightly planished tin or of silvered glass built upon strips to the required shape. The simpler forms are made often of one piece of silvered glass, sometimes ribbed or corrugated to produce a certain amount of diffusion. Similar reflectors are sometimes used in connection with groups of lights placed near high ceilings. Such services are quite useful in certain cases of ceiling and cornice lighting.

The general principle to be followed in any sort of display lighting is to place the lights so as to throw a strong light upon the objects to be brought into prominence without being themselves visible. The most useful direction of illumination is usually found to be downwards.

A good typical example is the illumination of a show window. This is accomplished far more readily by means of incandescent lamps

FIGS. 5 AND 6.—REFLECTORS.

than by any other radients, since these can be safely placed in almost any position. Such windows are usually high and embrace a space rather deep from front to rear. Fig. 3 shows a common and very effective plan of their illumination. At the top of the window close to the ceiling is arranged a long reflector with its working surface bearing backward and downward. In the reflector are located such a number of incandescents as may be necessary, turned sidewise, lengthwise of the reflector, as shown in Fig. 3, which gives a view of the arrangement looking towards the window from the inside. The lights should be 9 inches to a foot from socket to socket, and the reflectors should extend clear across the window. Fig. 4 gives an end view of the reflector, showing its shape, relation to the window and the method of suspension. The lamps in this instance are wired to a flexible cord. Ordinarily, 16-cp lamps are used for such work, but with especially high or deep windows 32-cp lamps are



FIGS. 7 AND 8.—DESK REFLECTORS AND PULPIT HOOD.

useful. Rarely, colored lights give a desirable effect, and in such case it is almost necessary to use 32-cp lamps to attain anything like sufficient brilliancy.

A similar scheme of illumination may be effective applied even to show cases. For this purpose a little reflector of polished metal, taking a lamp with a long and narrow bulb, as shown in Fig. 5, is extremely useful.

In cornice lighting, reflectors like Fig. 3 and Fig. 5 can be very advantageously employed, and indeed something of the kind should always be used when the cornice can be gotten at to keep the reflectors clean. No form of interior lighting gives a more beautiful effect, and by the adroit use of reflectors a fair degree of economy can be attained.

Picture galleries are lighted on much the same principle as show windows, and with similar apparatus. As a rule, the light should come strongly down upon the pictures at an angle of from 30 to 45 degs. away from the perpendicular. Generally several rows of pictures can be illuminated by a single long reflector, and the reflectors have to be hung from the ceiling far enough away from the wall and high enough to bring the light downward at a proper angle. In a few instances a small reflector may have to be carried out on a bracket from just above some especial picture in order to throw upon it sufficient light. As to the amount of light required in such situations, there can be laid down no very definite rule, but, as a rule, the lamps should be at least as closely set along the reflector as in the case of window lighting. The gross amount of light should be not far from 1 candle-power per square foot of vertical wall surface. The diffused light will take care amply of the general illumination. In case of very dark tones in the hangings even the lighting just mentioned may well be increased. With a generally light tone in finish and pictures, such a condition, for example, as might be found in an exhibition of engravings or water colors materially less than 1 candle-power per square foot would be found to serve the purpose.

For all such work ordinary clear bulb 16-cp incandescents are the main reliance, other sizes and kinds of lamps being only useful now and then. In some respects arc lamps would be very useful in display lighting, but they are too bulky to put behind any ordinary reflectors, and hence, in spite of the advantage of a clear white light, are seldom applicable. Ordinary incandescents of fairly high efficiency give a near enough approach to the proper color for all ordinary purposes. It is generally considered inadvisable to use gas light in any form for the illumination of picture galleries on account of the effect of the gas and its products of combustion upon the pigments. In one case within the author's ken all the high lights in some valuable sketches were turned black by the effects of illuminating gas. They had been put in with lead white, and the traces of sulphuretted hydrogen in the gas had in course of time done their work. In some instances an interposed glass ceiling to separate the gas jets from the gallery proper have been used with good effect, but there is small excuse for using anything but incandescent lamps in such places.

Frequently the use of reflectors is a great convenience in bringing into strong light some particular spot, and small reflectors on the general lines already shown are exceedingly convenient. Fig. 6 shows one along the same lines as Fig. 3, but arranged to take a single lamp. This would serve admirably to light up a single machine, or a dark corner in an office, such as exists far too often.

Such lighting should, however, be done rather cautiously, since, for example, a brilliantly lighted desk in a dark corner is apt to affect the eyes very seriously, as has already been suggested. For this reason some of the special desk reflectors like that shown in Fig. 7 should be used if at all, with bulb or containing shade very heavily ground to soften and diffuse the light, and with plenty of general illumination about the vicinity. This is but following out the general rule that strong level illumination should never be used alone, but always in connection with plenty of diffused light. With this proviso desk lights, like Fig. 7, are some times very useful.

Probably the most objectionable arrangement in use from a hygenic standpoint is the pulpit hood, such as is shown in Fig. 8. It is enameled white inside and contrived to throw a brilliant beam of light on the book while leaving everything about in darkness or the semi-obscurity that popular parlance associates with religious functions. It comes as near to being a bad eye machine as anything misplaced ingenuity has yet devised.

If it be really necessary for the stimulation of reverence or somnolence or the proper and righteous conduct of the service that the occupant of the pulpit should be in a dark corner then the pulpit light should be shaded in the least obnoxious way possible. Giving the hood an interior coating of deep cream colored enamel and providing it with an incandescent lamp of 8 or 10 candle-power with a lightly ground bulb, would cut down and soften the illumination while still giving all that is necessary or desirable. In a brightly lighted hall the intense spot from a hooded reflector is less troublesome, but it had still better be softened in some such manner as has just been suggested.

Storage Battery Auxiliaries—III.

BY LAMAR LYNDON.

DIFFERENTIAL BOOSTER.

THE differential booster is used on power and railway circuits where the load fluctuates widely and suddenly. There are several varieties of this type of booster, and many patents have been issued covering the different methods of varying the e. m. f. of the machine. Some of these patents appear to be identical with each other and lead to doubt as to the efficiency of the United States Patent Office.

The first booster patent issued was granted to C. O. Mailloux, June 24, 1890, under serial number 430,868. This patent covers the booster system shown diagrammatically in Fig. 6, and, in connection therewith, as a modification of the basic patent, a differential booster.

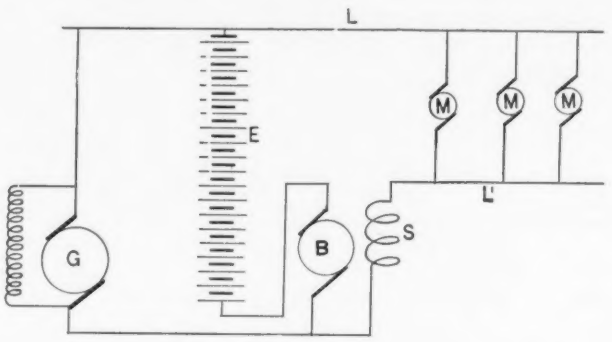


FIG. 6.

The original patent contemplates a battery E in series with a booster armature B. This series is connected across the mains L, L^1, the generator G being the source of supply. The total current supplied to the line passes through the series field s on the booster. It is evident that within the limits of saturation the e. m. f. of the booster will vary directly as the external load. This e. m. f. is opposed to the generator e. m. f., and tends to discharge the battery. When the load is light the e. m. f. is low and the generator e. m. f. overcomes it and the battery e. m .f. sends a charging current into the battery. At normal load the series field produces an e. m. f., which, added to the battery e. m. f., balances the generator e. m. f. and current flows neither into nor out of the battery. A load greater than normal raises the booster e. m. f., causing it to discharge the battery at a rate proportional to the external load.

The differential booster which appears in this same patent is as shown in Fig. 7. In this the shunt coil f opposes the series coil s, tending to produce an e. m. f. in the same direction as the generator

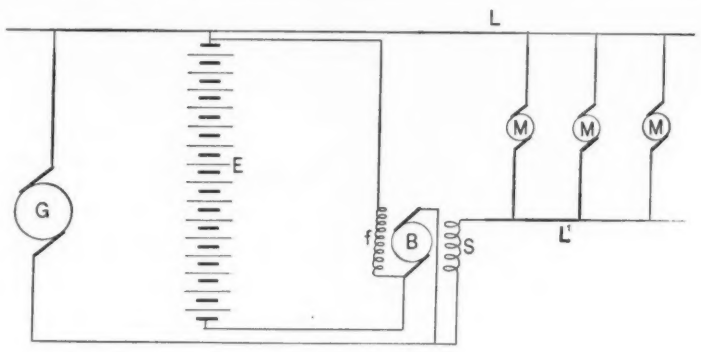


FIG. 7.

e. m. f., and to send current into the battery. At normal load the series and shunt coils balance each other and the e. m. f. of the booster is zero, and current flows neither into nor out of the battery. A heavy load causes the series to overpower the shunt field, and the e. m. f. of the booster is in such a direction as to discharge the battery. A load lighter than normal allows the shunt to overpower the series field, and the booster e. m. f. is added to the generator e. m. f., causing a charging current to flow into the battery.

Patent No. 589,186, granted to Meredith & Hunt, on Aug. 31, 1897, appears to be identical in every respect with the differential booster system patented by Mailloux in 1890.

Patent No. 651,664, granted A. S. Hubbard on June 12, 1900, and assigned by him to the Gould Storage Battery Company, of New York, describes a booster system which is as shown in Fig. 8. G is the supply generator, E a battery, B the booster armature connected in series with the battery, the two being connected across the mains, L and L^1. M is the armature of a counter e. m. f. generator connected in series with the field, f, of the booster, the two being also connected across the mains L L^1. A rheostat R is included in the circuit.

S is the field of the counter e. m. f. generator, and carries a current proportional to the total external load, the proportion being regulated by means of the adjustable resistance, r, which is in parallel with S. The operation of this system is as follows:

The e. m. f. of the booster is in opposition to that of the generator. The e. m. f. of the counter e. m. f. generator opposes the current glow through shunt field f of booster. The e. m. f. of counter e. m. f.

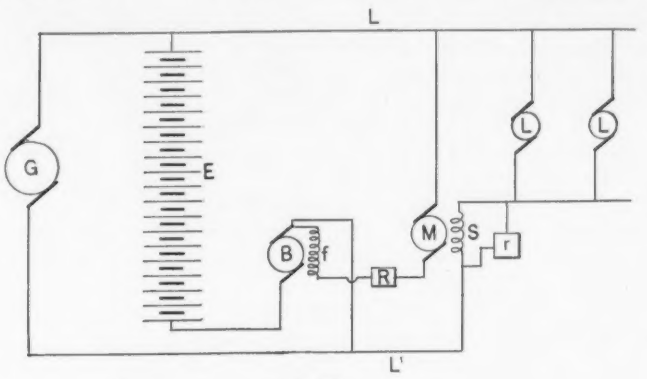


FIG. 8.

generator varies directly as the external load, thus causing the booster e. m. f. to vary inversely as the external load.

At normal load the battery e. m. f. plus booster e. m. f. balance the generator e. m. f. Decrease in load causes a higher booster e. m. f and a proportional charging current, while a load greater than normal reduces the booster e. m. f. and permits the batteries to discharge at a rate proportional to the excess of load up to a given point, which point is the magnetic saturation of the field magnets of M. This system was designed with a view to limiting the discharge of the battery, and in case of the load exceeding the normal capacity of both generator and battery, to cause the generator to operate at an overload rate and assist the battery.

The differential booster commonly used is a modification of that of Mailloux, and was patented May 16, 1899, under serial No. 625,098, by J. B. Entz. This system is explained by Fig. 9.

G is the generator, B the booster armature, E a battery, f the shunt field of the booster connected across the battery terminals, S_1 and S_2 series fields, L, L^1 the mains and M, M, the external load.

As shown, S_1 is in series with the generator and carries all current

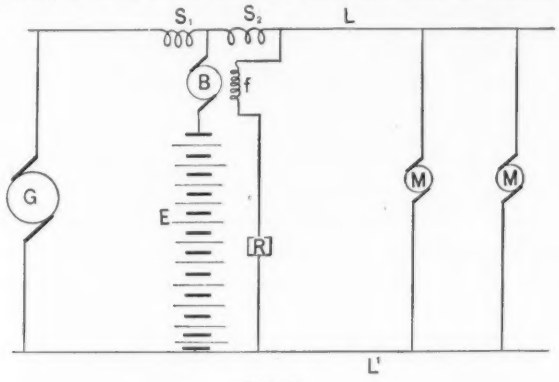


FIG. 9.

supplied, and at the rate at which the generator furnishes current. S_2 carries all current supplied to the external circuit, which, at any time, is equal to the algebraic sum of the generator and battery currents, when the generator and charging currents are taken as positive and discharging current as negative.

S_1 and S_2 act together to produce a m. m. f. opposed to that produced by the shunt field. As the object of this system is to maintain a constant load on the generator, S_1 may be considered as constant. The field then due to $f - S_1$ is constant. If at normal load $(f - S_1) - S_2 = O$, the booster e. m. f. will be zero, and there is neither charge nor discharge. As S_2 varies directly with the external load, an increase or decrease will result in a booster e. m. f. acting to discharge

or to charge the battery. The action is, in fact, the same as that of Mailloux's differential booster, considering $(f - S_1)$ as the equivalent of the opposing shunt field of Mailloux's system.

The reason of the application of S_1 lies in the fact that any considerable variation in the battery e. m. f. will disturb the equilibrium of the system unless this compensating coil is used. If the e. m. f. of the battery be lower than normal, it will not discharge rapidly enough to relieve the generator of overload fluctuations unless the booster e. m. f. be increased, and the generator will therefore have to supply a current greater than its normal capacity. If, however, a current greater than normal flows through the coil S_1 the value of $(f - S_1)$ is reduced, and S_2 still further overpowers the resultant of those two and causes a higher booster e. m. f. tending to discharge the battery, and thus bringing down the generator load to normal. Should the battery e. m. f. be above that it ordinarily has the reverse operation will take place; the battery tending to discharge too rapidly will be brought down and the generator allowed to take its share of the load, because of the booster e. m. f. being lowered by decreased current in S_1 due to light load on the generator.

This system is entirely automatic with the exception of occasional variations in the strength of shunt field f effected by means of rheostat R to compensate for changes in the battery e. m. f. It is adopted for systems supplying both light and power, where the lighting mains are connected to L and L_1 between the booster and the generator forming a non-fluctuating load.

The fluctuating load must be connected to the mains *after* they pass through their proper booster connections.

In the compound booster system, it will be remembered, power can be taken from either side of the booster connections.

As in the case of the compound booster, the battery may be made to help the generator carry the peak of the load as well as take up the fluctuations. This booster will operate satisfactorily with a compound-wound generator as the source of supply. In calculating the size and windings of this booster the following analytical discussion is necessary:

At normal load and normal battery voltage there should be neither charge nor discharge, and the booster voltage should be zero. Let the maximum voltage of battery equal $2.3\ N$, N being the number of cells in series. The normal voltage equal $2\ N$. The voltage due to the shunt coil should be *not less* than $(2.3\ N - 2\ N) = .3\ N$.

Let E_M = Maximum generator voltage.
E_A = battery voltage.
V = booster e. m. f. due to shunt coil.
I_x = generator current.
R = battery circuit resistance, including booster armature.
t_1 = number of turns in coil S_1.
t_2 = number of turns in coil S_2.
I_0 = current in external load.
K = volts produced per ampere-turn on booster field.
h = volts drop in generator voltage per ampere of generator current.

If I_x be first assumed as equal to the average generator current, then $E_M - I_x h$ = normal voltage at booster and battery terminals = E_0. If the generator is compounded to give a constant e. m. f., $h = 0$. If it be overcompounded h is negative and $E_0 = E_M + I_x h$.

In order that booster voltage shall be zero when I_0 = average generator current.

$$I_x (t_1 + t_2) K = V \quad \therefore \ t_1 + t_2 = \frac{V}{I_x K} \tag{16}$$

As the load increases, the voltage due to the series coils must exceed V by an amount equal to the drop due to resistance of battery circuit, or

$$K (I_x t_1 + I_0 t_2) = V + R (I_0 - I_x) \tag{17}$$

the current supplied by the battery being $I_0 - I_x$. As I_x is to remain constant, the increase of series m. m. f. must be supplied by coil S_2. Then $K t_2 (I_0 - I_x) = R (I_0 - I_x)$, or $t_2 = \frac{R}{K}$ (18)

From these equations, the windings of the three coils are determined. In using the factor K a constant permeability and straight line characteristic are assumed. This is sufficiently true for practical purposes. Remembering that the shunt coil voltage varies with variation in E_A, if connected across the battery terminals, V becomes

$$\frac{V E_A - V R I_0 + V R I_x}{E_N} \tag{19}$$

in which E_N is the normal voltage of E_A.

With the shunt coil connected across the line, the equation of e. m. f.'s is

$$I_x t_1 K + I_0 t_2 K - V - E_0 + E_A + R I_x - R I_0 + I_x h = 0 \tag{20}$$

But $t_2 K = R$ (equation 18). Therefore,

$$I_x = \frac{V + E_M - E_A}{t_1 K + R + h} \tag{21}$$

This shows I_x to be constant with a given value of E_A whatever the load variation.

If, however, the shunt coil be connected across the battery equation (20) becomes

$$I_x t_1 K + I_0 t_2 K - \frac{V E_A}{E_N} - \frac{V R I_0}{E_N} + \frac{V R I_x}{E_N} + I_x h - E_0 + E_A + R I_x - R I_0 = 0 \tag{22}$$

whence

$$I_x = \frac{E_0 + \frac{V E_A}{E_N} - E_A + I_0 \frac{V R}{E_N}}{t_1 K + R + \frac{V R}{E_N} + h} \tag{23}$$

With a given value of E_A, all the terms of this equation are constant, except I_0, showing that I_x varies with I_0. The factor $\frac{V R}{E_N}$ is, however, small. When battery voltage is normal, $E_N - E_A$, and

$$I_x = \frac{V + I_0 \frac{V R}{E_A}}{t_1 K + R + \frac{V R}{E_A} + h} \tag{23}$$

Consider now the concrete case of a railway circuit having the following characteristics:

$E_M = 500$ volts $= 2\ N$.

$n = \frac{500}{2} = 250$ cells.

$V = 3\ N = 250 \times 3 = 75$ volts, say, 76.
$I_x = 100$ amperes average.
$I_0 = 400$ amperes maximum.
$R = 0.2$ ohm.
$K = .02$ volts per ampere turn.
$h = 0 \ \therefore \ E_M = E_0$.

Computations based on normal battery e. m. f.

$E_A = 500$ volts.

$t_1 + t_2 = \frac{76}{100 + .02} = 38$ turns.

$t_2 = \frac{.2}{02} = 10$ turns $\therefore \ t_1 = 28$ turns.

As, in practice, the battery is connected across the line, V is practically constant. Therefore, with E_A normal there will be no variation in I_x, whatever the load. If the line potential varies appreciably, equation (23) should be used, substituting line changes for battery changes.

I_x maximum occurs when E_A is minimum.

$I_x = \frac{500 + 76 - 475}{.56 + .2} = 132.9$ amperes. I_x is minimum when E_A is a maximum.

$I_x = \frac{500 + 76 - 575}{.76} \doteq 1.3$ amperes.

Therefore, t_1 must be large enough to carry 133 amperes; t_2 and armature must carry $400 - 1.3$, or practically 400 amperes. These extremes are only reached when the battery is used for carrying the peak of the load as well as compensating for fluctuations.

When used for regulation only, the battery voltage will vary but little, and the booster need not be so large as the foregoing figures

would seem to require. Proper attention to the rheostat can prevent I_x from reaching the maximum value given, though the minimum value cannot be increased without increasing V, which would increase the size of the booster.

If the shunt coil be made to give a lower voltage on normal operation, than the figure assumed by using a rheostat, t_1 will be reduced; and while the regulation will be the same as that given when E_A is at its normal voltage, it will not be so good when E_A varies from normal. For good regulation with variation of E_A, T_1 must be large, which requires that V_2 be large. Therefore, the full value of V or $V_{max} = .3N$, should be the normal working shunt voltage. Increasing V improves regulation, but increases the size of the booster, the size of machine required varying with the regulation necessary.

This type of booster is commonly installed with a switch to short circuit S_1 and S_2, and allow the shunt coil only to act when a rapid battery charge is desired. The size of booster necessary in the case just considered would be $400 \times 76 = 30.4$ kw considering shunt voltage only.

The series coils always oppose the shunt coils, and do not add materially to the capacity required of the machines, though the magnet limbs must be long enough to accommodate them. Since the maximum demand seldom comes and only lasts a few moments, 70 per cent of the calculated capacity is large enough to make the machine in the present case equal 22 kilowatts.

If $V = 76$ when $E_A = 475$—which would be the case if the battery should discharge down to minimum and the rheostat receive no attention—the booster voltage on maximum external load $= 76 - (28 \times .02 \times 133) - (400 \times 10 \times .02) = 78.48$ volts, or the amperes through the booster are 267. The product of these, or 19.9 kilowatts, is the maximum of the product of volts multiplied by amperes at any instant, and fixes the size of the motor required to drive if the booster is used only.

Street Railway Standards.

The committee on standards of the American Street Railway Association held a meeting at Niagara Falls, N. Y., on June 3. The object of the meeting was to map out the preliminary work of the committee. An abundance of material, which had been gathered by the secretary, was placed before the committee for consideration. It was apparent, from the data in the hands of the committee, that both street railway operators and manufacturers of street railway appliances are much interested in the work of standardizing street railway equipment. It was decided that the best results could be obtained by apportioning the work among the members of the committee, each member to act as a sub-committee on certain parts of the work assigned to him, with power to incur reasonable expense in the preparation of plans and specifications, and to report at the next meeting of the committee. The following assignments were made: To consider two forms of rail, the "T"-rail and a grooved girder rail, each with a modified form of head. To consider two forms of wheels, one a cast chilled wheel, with either spokes or plate center, the other a steel tired wheel, with either spokes or plate center, tread and flange of wheel to conform to the rail to be recommended. To consider the wearing parts of trucks, the center-bearing swing bolster for double trucks to be recommended. To consider a standard for axles, journals, journal brasses, oil-boxes and brake-heads, such as will fit the trucks of different makers.—Mr. N. H. Heft, Meriden, Conn.

To consider electric motors with a view to standardizing all parts of the motor, including suspension, lead wires with connector boxes and ventilation.—Mr. W. J. Hield, Minneapolis, Minn.

To consider single truck and double-truck car bodies, including open cars, for city and suburban service, in order to determine wherein such cars can be standardized to meet the requirements of various conditions of operation, with due regard to proper ventilation.—Mr. John R. Graham, Boston, Mass.

To consider the standardizing of overhead material as far as practicable along the following lines: Trolley wire, trolley wheels, trolley ears, trolley hangers, span wires, pull-off wires, section insulators, cut-outs, overhead frogs and switches, lightning arresters and all parts that go to make up the overhead system.—Mr. C. F. Holmes, Kansas City, Mo.

Mr. T. E. Crossman, 1829 Park Row Building, New York, is secretary of the committee, and will be glad, on behalf of the committee, to receive communications bearing on the above-named subjects from many interested persons.

Berliner on Telephone Transmitters and Exchanges.

A very interesting article is contributed by Mr. Emile Berliner to the *Saturday Evening Post* on "Ideas Worth Millions." In regard to the telephone he gives some very striking reminiscences as follows:

The invention of the constant-contact telephone transmitter which made long-distance telephony possible and rendered short-distance talk clear and intelligible was the result of something of the same kind. I had for years been studying the science of electricity and the physics of sound when Mr. Bell's patent was issued in 1876, and it occurred to me at once that the knowledge I had absorbed in my studies might be very profitably applied to improving the telephone.

At that time I was engaged in commercial pursuits in Washington, and my experiments and studies were more in the nature of a recreation than anything else. I paid frequent visits to the central office of the Fire Department, the electrical superintendent of which, Mr. Richardson, was a particular friend of mine. He had a dummy telegraph instrument on which he had taught me telegraphy, and on this particular evening I was working the instrument as usual, when he said:

"You don't press hard enough, Berliner."

"Does that make any difference?"

"Certainly; it makes all the difference in the world in the strength and clearness of the message at the other end. That is why women do not make good and effective operators as a rule. They are not strong enough—their touch is too light. They do not give thorough contact."

That was a revelation to me. Under Mr. Bell's invention the voice had to vibrate a diaphragm against a magnet and the volume of electricity thus produced was not sufficient to transmit sound waves sufficiently strong. That night, before I went to sleep, I had set up the movable diaphragm used in the telephone to-day, which keeps in constant contact, but with varying pressure, with the transmitting end of the telephone wire, simply pressing back and forth as the sound waves produced by the voice diminish or strengthen.

Another case illustrating this point occurred not so many years afterward. Upon the completion of my invention of the constant contact sound transmitter, the Bell telephone people engaged my services as expert to aid in perfecting the telephone, which was still in a crude state. Mr. Blake had just invented his form of transmitter and the instrument was placed in my hands for final development. It secured a very much clearer transmission than had been possible before, but one of its troubles was that the carbon button used would rapidly wear holes at the contact. The material was so soft that it kept us busy replacing or refacing the carbon buttons. These buttons were made from the ordinary long soft carbons used in arc lights, which had only just appeared in the market. They were made by sawing the long carbons into thin circular buttons. We conducted all sorts of experiments with a view to securing a hardening of this carbon, but for a long time we failed in effecting any improvement. It was well known that the hardest carbon in the world was that which is deposited in gas retorts. This carbon deposit had always proved a serious source of trouble since the manufacture of coal gas was invented, because it has to be cleaned out from time to time, and this is a difficult job.

It occurred to me to have a little iron cage built, into which I put a lot of our soft carbon buttons. This cage I asked the gas people in Boston to put into their retort on the next occasion when they were ready for a charge. I left it there during six charges; then, when I took it out, I found my carbons all shriveled and shrunken. The intense heat had half burned them up. They were all rough, and for a little while I thought there was another failure. In a contemplative mood I began to rub one of the roughened buttons on a piece of emery paper to see what polishing might do for it. Soon I had rubbed away entirely the spongy rough surface and got down to the original button. Examining this closely, I found to my great surprise that the carbon itself was practically unchanged except that it had become tremendously hardened. A closer inspection showed that not alone had the carbon in the gas deposited itself on the surface of the buttons, but that it had also penetrated the pores of my carbon, filling them up absolutely and making the buttons as hard as any one could desire. That was in the year 1879.

By exposing to fewer gas charges we thereafter produced a carbon button that was at once hard and smooth, and to this day this process

is employed. Nothing has ever been found that hardens carbon buttons for telephone use better or more economically.

As to the telephone exchange idea, he says:

One inventor may have something that, as it stands, appears to show only a comparatively small field of usefulness, but which, worked out under given conditions, will become a gold mine. The telephone again illustrates this. None of the men who worked at this idea originally had any conception of its possibilities. For some time after the apparatus was perfected by Mr. Bell, and even after Mr. Edison, Mr. Blake and myself had made our improvements, nobody appreciated the vast possibilities of the telephone. It was declared useful only as a means of communication between two points on a private line; between a man's office and his factory, his place of business and his home.

It was only when there was applied to it the central office idea that the telephone became important and really valuable. None of the men originally concerned with the invention thought of it immediately in connection with a central office. This idea grew out of the working of what was known as the Law Telegraph Company, of New York, and the credit of applying the idea undoubtedly belongs to the late Gardiner G. Hubbard and to Mr. Theodore N. Vail. Mr. Vail was general manager of the Bell Company. Mr. Hubbard from the first was the main factor in the initial development of the scheme.

The Law Telegraph Company was an institution organized for the benefit of the lawyers of New York. There was a central office, out of which ran private lines to the offices of the lawyers who subscribed. When one lawyer wanted to communicate with another, his operator called up the central office and the latter's line was connected by the usual plug system with the line of the man he desired to telegraph to. In other words, they did exactly what is now done in the telephone central office, only using the telegraph keys and skilled operators instead of telephone transmitters and receivers. To-day there are more patents on central office appliances than on the telephone instruments proper.

Necessities of the Central Union Telephone System.

Mr. J. I. Sabin, who has recently been elected president of the Central Union (Bell) Telephone Company, has issued the subjoined startling circular to his stockholders. On its appearance the stock dropped in Chicago from 53 to 34. The document is as follows:

After two months' investigation—the last month in charge as president—I find that it is imperatively necessary that at least $3,000,000 be provided without delay—that is, one-half immediately, and one-half before the close of the present year, 1901; with a call for another $1,000,000 during the first half of the year 1902 and one more for the same amount during the last half of 1902, making a total of $5,000,000. (This sum in addition to the net income during the period named.)

The issue of bonds under present mortgages has reached its limit. The net revenue will not allow extensions rapidly enough, and while there have been a great many proposed modes of getting the money, in my opinion, the most practical is one of the following three:

1. For you to agree to a voluntary assessment of $20 per share immediately, $20 per share before Dec. 31, 1901, and $20 per share during 1902.

Or 2. For you to agree to loan the company the same funds, at the same time, at 4 per cent interest.

Or 3. For you to agree to purchase your share of the unissued capital stock of this company, at par. The amount is $3,000,000.

And if the great majority, practically, all of the stockholders, will not agree to one of these three propositions, nearly all new work must stop, and that simply means going backward instead of forward.

There is no use crying over spilled milk, or abusing one another for things not accomplished. The people of the States of Illinois, Indiana, Ohio and Iowa want telephone service. Will you supply it, or must some one else?

Are you doing it with less than 70,000 stations?

No. When you have 300,000 exchange stations then you have a good start, not before.

When you have 150,000 exchange stations, at proper rates, you will have a plant upon which you can earn something, with which to build up the second 150,000. Your territory needs 300,000 stations.

With your present 70,000 stations, the great majority of them at insufficient rates, thousands of them absolutely without charge, you cannot build up anything—except opposition.

You are not satisfying the public, because your system does not reach far enough. There are scores of villages and small towns, taken as a whole, that should have over 50,000 telephones, and in which the Central Union Telephone Company has not one single instrument.

The opposition are not satisfying the public.

The property is yours, not mine.

Do you want to build it up to its proper standard?

Time is the very essence of value to your property.

What you want done must be done now. Later on, and a very little later at that, will be too late.

Will you agree to No. 1?

Will you agree to No. 2?

Will you agree to No. 3?

I am sure 70 per cent of our stockholders will agree to either 1, 2 or 3.

What will you agree to do?

It is stated that 51 per cent of the capital stock of the Central Union Telephone Company is owned by the American Telephone & Telegraph Company. They are also carrying over $1,000,000 of the company's temporary loan.

Electrolytic Manufacture of Metal Papers.

Some 35 years ago a keen rivalry arose between certain British manufacturers as to which could produce the largest and thinnest sheet of iron, the competition beginning with a letter inscribed by the Sligo Iron Works upon a sheet containing 270 square centimeters, and weighing but 4.469 grams, and reaching its climax in the plate produced by the Hope Company of Tipton, having an area of 1425 square centimeters and a weight of 11.529 grams, the weight being thus about 8 milligrams per square centimeter, and the thickness perhaps one-quarter that of the thinnest tissue paper. These sheets were, of course, useless save as illustrating the manipulative skill of the makers, and since the malleability of a metal is closely related to its purity, as showing the high grade of their material.

Shortly thereafter, in 1873, Wood described his electrolytic method for the production of foils by deposition of the metal upon a base from which it could be stripped. By this means sheets far thinner than any process of hammering or rolling could possibly yield were readily produced, and in 1879 Professor Egleston, of Columbia College, exhibited before the American Institute of Mining Engineers a piece of gold leaf produced by Alex. E. Outerbridge, of the Philadelphia Mint, and probably the thinnest piece of metal which has ever been handled alone. This sheet was 5.7 mm. square, and so light as to be without appreciable effect upon a balance. Its thickness was estimated to be less than .00015 mm.—1-100 of the wave length of green light, or 1-15,000 of the thickness of ordinary printing paper. By transmitted light it was of a pale yellow color, or where double, light green, and was perfectly transparent so that the finest print could be read through it with ease. The method employed by Outerbridge consisted in rolling a sheet of copper to a thickness of 1-200 mm., and after careful cleaning and burnishing electropating upon it the thin film of gold. Several days floating, copper side down, in dilute nitric acid, sufficed to remove the copper, leaving the gold film, which was then floated upon glass and dried.

Such films possess merely a scientific interest, and are comparable to the attached transparent coatings of metals or of oxides produced at about the same time by Professor Wright, of New Haven, through the medium of the vacuum discharge. Heavier electro-deposits, either detached as leaf or foil or backed by paper, and often patterned by electro-deposition upon an engraved base, find application in many directions, and have been the subject of numerous patents, especially during the past 10 years. Most of these relate to improvements in the treatment of the cathode to facilitate the removal of the deposit, for the solution method of Outerbridge is obviously inapplicable to a commercial process, and the slightest local adhesion will mar or deface the foil. This treatment may consist in exposing the cathode, before plating, to the fumes of smoke or the vapors of iodine, in washing it over with a solution of soap, wax, or fatty matter, in coating it lightly with oil or graphite. Or if the cathode be of nickel, it may be slightly oxidized, but in general treatment with sulphide solutions has been found most satisfactory.

The most recent development in this line is covered by a patent issued June 11 to Carl Endrumeit, of Berlin, describing a continuous

process for the production of "metal papers" or paper-backed foils. An endless belt of metal moves past a rotary polishing roller which removes stains or irregularities, then over a tank containing a dilute solution of potassium trisulphide with which the polished face of the belt is moistened by means of a cylindrical brush. This forms upon the surface a layer of sulphide, imperceptible to the eye, yet sufficient to prevent too close adherence of the metal afterward deposited. After wiping and rinsing, the belt dips into the first plating vat, and receives, over the sulphide, a thin coating of nickel, then into a second vat where this film is reinforced by a heavier deposit of copper. After further brushing and rinsing a coating of glue is evenly applied to the layer of copper, a strip of paper is fed upon it from a roll, and belt, deposit and paper pass together through rubber compressing rolls and a drying chamber. The deposited film adheres far more strongly to the paper backing than to the polished and treated metal belt, so that the finished metal-faced paper is readily stripped and wound, while the belt passes again to the polishing roll and the electroplating vats.

A polished cathode-belt yields a paper with a brilliant nickeled surface, and by the addition of mercaptans or other sulphur compounds to the glue, the backing adheres so strongly that the product is thoroughly serviceable and very attractive. If the paper be intended for wrapping articles for sale, appropriate letters or designs are readily produced in it by engraving the cathode, the finest details being reproduced in reverse in the face of the paper.

Canal Operation by Electricity.

The Miami & Erie Canal Transportation Company, which controls the lease by T. N. Fordyce on the Miami & Erie Canal, has been reorganized and has passed into the hands of a strong syndicate of Cleveland capitalists, all of whom are prominent in electric railway enterprises. At a recent meeting of the company directors were chosen as follows: H. A. Everett, E. W. Moore, M. J. Mandelbaum, F. T. Pomeroy, E. G. Tillotson, L. J. Wolf, R. A. Harmon, W. H. Lamprecht, F. N. Wilcox, H. B. McGraw and C. W. Collister, all of Cleveland; Will Christy and J. R. Nutt, of Akron; D. J. Ryan, Toledo; T. N. Fordyce, of Detroit. Officers: W. H. Lamprecht, president; W. S. Hayden, secretary, and Otto Miller, treasurer. The company is capitalized at $3,000,000, and at the meeting mentioned it was found that the stock had been oversubscribed to the extent of nearly 35 per cent. The character of the organization indicates that it is far from being the visionary project that it has sometimes been considered. The franchise gives it the use of the canal from Cincinnati to Toledo and, contrary to the impression which has been freely published, it is strictly a freight "proposition." There is no intention, nor would it be possible, to operate passenger cars on the tracks, which will be built on the bank of the canal. Under the terms of the grant, the speed of the boats, which are to be propelled by electric motors, is restricted to four miles an hour. The bridges over the canal give only a four foot clearance, so that it will be necessary to design a special electric locomotive. Boats will be towed in strings of four, and perhaps six boats, with a carrying capacity of 75 tons each. It is believed that two men will be sufficient to operate a string of boats; an operator on the electric locomotive and a helmsman on the first boat. As a freight carrying enterprise, it is claimed that the canal furnishes a most attractive investment. The cost of operation will be small, as the power required to operate boats at such a slow speed is very slight. It is believed it will not even be necessary to build power houses, since sufficient current can be obtained from the railway power stations along the route. The canal passes through more than a hundred prosperous villages and towns, and numerous manufacturing establishments are located by preference along its banks. This would dispense with the expense of hauling freight. The canal is crossed by numerous east and west trunk railroads, thus giving connection with all parts of the country. Manufacturers and merchants in towns along the route are much interested in the project, in view of the fact that it is claimed that the canal freight rates will be much lower than those made by the railroads. Boats will be operated through the various towns at regular intervals, and it is believed that the canal can be kept clear of ice, so that it can be operated all the year around. Work of dredging, building tracks and strengthening locks has already been started near Hamilton, and it is stated that the section between Cincinnati and Dayton will be in operation this year. T. N. Fordyce has been appointed general manager of the company, and Warren M. Bicknell, at present auditor of the Southern Ohio Traction Company, will be traffic manager of the new company. F. A. Lytle, of the Standard Construction Company of Detroit, is the engineer, with headquarters at Cincinnati.

CURRENT NEWS AND NOTES.

TELEPHONY IN RUSSIA.—It is stated that the municipal council of St. Petersburg is about to send an electrical expert to this country to study the development of the telephone system. St. Petersburg has a new plant under consideration.

ACCIDENT RECORDS.—From returns compiled in France, it would appear that accidents from horses are by far the most numerous. The proportions are roughly as follows: The horse, 82 per cent; steam railways, 9 per cent; automobiles, 3 per cent; bicycles, 7 per cent.

ELECTRICITY IN MINES.—A special dispatch from Pittsburg of June 16 says: "The explosion and loss of life at the Port Royal mine may cause a conflict between mine owners generally and the State Mine Inspectors. After the Port Royal accident Mine Inspector Isaac Roby inspected the Grindstone mine near Brownsville, close to the Bragnal mine, in which there was much loss of life last year. Roby says the Grindstone mine is gaseous, and he ordered the electric mining machines taken out, asserting that sparks from them were liable to set the gas off. The owners appealed to Chief Mine Inspector Roderick, who will decide the question. If electric mining machines are officially declared dangerous and ordered out of the mines it will mean a loss of millions to the mine owners.

CURING LUPUS.—A special dispatch from London of June 15 says: "The large subscriptions flowing into the London Hospital to carry on the experiment in the use of electric light to cure cases of lupus have caused a little controversy between the surgeons in charge of that work and those using the Roentgen rays for the same purpose at the London Skin Hospital. It seems that the latter experiments have been going on for some time and cost less, because the apparatus used to concentrate the Finsen rays of electric light in the other system is expensive and a long time is required at each exposure. But the use of the Roentgen rays is always attended with some danger to the patient, and the results at the London Hospital, where experiments have been going on under the direct patronage of Queen Alexandra, are, on the whole, much more satisfactory."

RIVER PROFILES.—An interesting and valuable publication of the Department of Hydrography of the United States Geological Survey on the Profiles of Rivers in the United States, by Henry Gannett, has just been published and is now available for distribution. It embodies within a hundred pages the leading facts of about one hundred and fifty of the most important rivers and streams of the country, noting their length, drainage area, the location of water power in their courses, their peculiarities of flow and the nature of their drainage basins. The rivers selected are those which are the largest in size and bear most directly upon the varied interests of the country, such as the Connecticut, Hudson, Susquehanna, Ohio, Potomac, Mississippi, Missouri, Platte, Colorado, Sacramento, Columbia and others. The figures for the tables showing height above sea level and fall per mile were collected from various sources. Some were obtained from the report of the Chief Engineer of the United States Army, some from railroad companies when their lines cross the streams and some from the atlas sheets of the United States Geological Survey. In the case of such rivers as the Connecticut, Susquehanna, Mississippi and Colorado, where the surrounding country is, in part or whole, of peculiar physiographic interest, very excellent and vivid descriptions of its leading physical characteristics are given which add to the interest and render it valuable from an educational standpoint in geographic and physiographic instruction. The pamphlet is the result of much careful work and is the first attempt to collect and compile this information in its present form.

UNIVERSITY OF ILLINOIS ANNUAL.—The current volume of *Technology,* published annually by the Association of Engineering Societies of the University of Illinois, contains five papers on electrical subjects, following being the titles: "Regulation and Adjustment of Arc Lamps," by M. E. Chester; "Electrically Operated Railway Signals," by F. J. Postel; "An Inexpensive Mirror Galvanometer," by A. P. Carman; "Regulation of Alternators Under Variable Loads," by G. W. Redfield; "Commercial Electric Meters," by G. R. Radley.

ELECTRICAL POWER DISTRIBUTION.—At the recent Milwaukee meeting of the American Society of Mechanical Engineers, Prof. W. S. Aldrich read a paper on "The Requirements of Electricity in Manufacturing Work," in which are set forth principles based upon actual experience. The subject is treated under the heads of general considerations, economics of electricity in manufacturing, influence of electric transmission upon factory building, influence of electric transmission upon workshop expansion, influence of the electric drive upon the arrangement of machinery, changing from the old to the new system of driving, application of the electric drive, selection of equipment, losses in factory transmission, efficiency of electric transmission and operation, and testing of factory installations.

WIRELESS TELEGRAPHY IN CANADA.—It is not unlikely that experiments in marine signaling, by means of the Marconi system of wireless telegraphy, will be made in Canada this summer. The only point at which it would be of utility to incoming ocean steamers is at Belle Isle, which, however, has not yet been connected with the Government coast telegraph system. It is expected that the land line will be completed along the Labrador coast to Chateau Bay by the first of July next. From that point to Belle Isle, the connection will have to be made by cable across the strait, a distance of 28 miles. The cable has been purchased and will be laid some time during the summer, but by the time it would be available steamers would probably be abandoning the Belle Isle route for the season. Experts have grave doubts as to whether a cable can be maintained across the Strait of Belle Isle, on account of the danger of its being cut by grounding icebergs during the winter and early spring. It may be therefore that tests of the practicability of the Marconi system will be made between Belle Island and the mainland.

A MARCONI PATENT.—In a patent issued June 11 to Guglielmo Marconi a new type of wireless telegraph ærial wire is described. As illustrated, there are two conductors, one concentric with the other. At the transmitting end one of the sparking balls of the induction coil is connected with the outer conductor and the other ball connected, through an adjustable inductance, to the inner conductor, the latter being grounded. At the receiving end one terminal of the coherer primary circuit is connected with the outer conductor and the other terminal connected through an inductance with the inner conductor, which latter is also grounded. (In the Marconi system the ærial circuit is, by means of a transformer, in inductive relation with the coherer circuit.) The specifications state that communication of signals may be greatly facilitated by this employment at each station of two ærial conductors insulated from each other; and that advantageous results are attained by the inclusion of the inductancies referred to, which are capable of wide variations of self-induction, thereby enabling the resonance of the inductances at the transmitting and receiving stations to be harmonized, and the receiving apparatus caused to respond readily to the oscillations sent from the transmitting station.

GOVERNMENT CONTROL OF TELEGRAPH AND TELEPHONES IN CANADA.—The Ottawa Board of Trade has made a practical departure that must bring the question of governmental cable, telegraph and telephone services to the attention of business men in all parts of the British Empire. A circular letter has been drafted and will be forwarded to boards of trade and chambers of commerce throughout the United Kingdom and the colonies, urging the importance of the establishment of State-owned cables connecting the mother country with other parts of the empire. The proposal requires that not only the connecting transmarine cables shall be under Government control, but that land telegraphs, in the several British possessions, shall be State-owned. Canada is the only important part of the empire in which the telegraph service is in private hands, and the circular alludes to the report that the transfer of the Canadian telegraph lines to the Post Office Department, and the laying of a State-owned cable across the Atlantic, are now under consideration of the Dominion Government. The question of establishing the telephone service under management will also soon come up for consideration by the Government.

STORAGE BATTERY CHARGING.—A patent issued June 11 to H. F. Parshall , of London, describes a means whereby a current of variable e. m. f. suitable for charging storage batteries may be attained, the e. m. f. as the charge proceeds being increased in order to compensate for the increased e. m. f. of the battery. This object is attained by making use of a rotary converter having a series winding arranged so as to act in opposition to the shunt winding, the converter being supplied from an inductive alternating current source. If, for example, the current supplied by the rotary converter tends to diminish, the demagnetizing effect of the series winding is decreased, thereby causing a resultant increase in field strength of the converter. This increased excitation advances the phase of the current supplied to the converter which, by reacting upon the inductive supply circuit, increases the e. m. f. of the converter, thereby correspondingly increasing the direct current e. m. f. The converter thus has a tendency toward constant current regulation rather than toward constant potential regulation. As illustrated, there are two rotary converters. One of these supplies the main current for charging, and the other is an auxiliary rotary in series with the storage battery. The direct-current terminals of the auxiliary, or booster rotary converter, are supplied with current derived indirectly from alternating current supply mains through the medium of transformers. These transformers are especially constructed so as to have considerable leakage between the primary and secondary wires, the transformer circuit thereby being given the necessary inductance.

FREQUENCY EQUALIZATION ON ALTERNATING-CURRENT CIRCUITS.—In the operation of alternating-current systems to which synchronous motors and rotary converters are connected, considerable difficulty arises owing to momentary fluctuations of frequency in the system. The speed of such machines frequently surges backward and forward with considerable violence, this phenomenon being known as "hunting," and if one machine commences to hunt it transmits this tendency to other machines, and the action of each machine magnifies or increases the hunting of the other. Fluctuations in the frequency may also be due to variations in the angular velocity of the prime mover, in which case synchronous machines are often caused to hunt in unison with such periodic fluctuations, or to be started hunting with periods of their own. To overcome the difficulties mentioned is the object of a patent granted June 11 to Ernst J. Berg. To this end use is made of an induction machine of high inertia, the machine being so chosen that its inertia bears a fairly large ratio to the inertia of the machines connected to the alternating-current system. The induction machine has preferably a very low armature resistance so as to have close speed regulation; and on its shaft is also mounted a fly-wheel of comparatively large inertia. The close speed regulation renders it more sensitive in its action and causes it to respond more powerfully to small variations of frequency, while the fly-wheel has a tendency to cause the machine to run at a uniform speed. When, therefore, fluctuations in frequency occur in the system the induction machine does not respond to these by adjusting its speed thereto, but, on the contrary, has a tendency toward uniform rate of rotation. The result is that when the frequency drops, due to hunting or other irregularities, the induction machine is left running at a speed greater than that corresponding to the new value of frequency, thus acting as a generator and momentarily supplying additional driving power to the system and so opposing the drop in frequency. On the other hand, when the frequency rises momentarily the torque of the machine is thereby enormously increased owing to the drag due to the inertia of the moving parts. It therefore acts as a powerful brake and tends to prevent increase in frequency. When the frequency of the machine is constant it acts normally as a motor.

TWELVE HOURS UNDER WATER.—The submarine boat Narval concluded a twelve-hour submersion test at Cherbourg, France, on June 15, with the object of ascertaining the effects upon the crew. The test proved that the strain is too much. The confinement and lack of fresh air produced nausea and exhaustion after a few hours. The tension was so intense that the men were unnerved.

A GERMAN TECHNICAL BUREAU.—Deputy Consul-General Hanauer writes from Frankfort, May 18, 1901: "Steps are being taken for the creation of a federal bureau of technics in Germany. On the executive committee having charge of this plan are members of the leading chemical works, the German association for protecting the trades, the Technical Association of Germany, the Association of German Engineers, the Union of German Patent Lawyers, the Central Bureau for Scientific Investigation, the Institute for Fermentation, the German Tobacco Association, leading electrical companies, and others.

NIAGARA POWER IN TORONTO.—It is reported that power from Niagara Falls will soon be delivered in the city of Toronto under the auspices of the Toronto Railway Company, the Toronto Electric Light Company, and possibly the Gas Company. The Toronto Street Railway will take 10,000 horse-power per year, and the Toronto Electric Light Company, for itself and customers, about 5000 horse-power. The rate for this power, delivered at the borders of the city, will be $25 per horse-power per annum. This rate is for power for an entire day of 24 hours.

A NEW STORAGE BATTERY.—A Rochester, N. Y., dispatch states that Mr. Walter Scott Strowger, the inventor of the Strowger automatic telephone switch, has invented a storage battery which he claims is superior to anything now on the market, or promised. The dispatch adds that Mr. Strowger stands ready to take the Empire State Express from Rochester to New York by the use of his battery. The dispatch also states that Mr. Strowger has discovered a new gas similar in illuminating power to acetylene, but without the latter's dangerous qualities. The bi-products, it is stated, are more valuable than the gas itself.

WEATHER SERVICE IN THE PHILIPPINES.—The Jesuit fathers of Manila maintained a meteorological observatory for many years. Since 1894 Father Algue has made a special study of the typhoons of the region. His extensive report on the subject is now in course of publication as a Congressional document (Senate document No. 138, Fifty-sixth Congress, first session). Early in 1900 a Philippine Weather Service (independent of the United States Weather Bureau for the present) was organized, and it is now in operation. Some 20 telegraphic stations are equipped and in correspondence with the central office at Manila. The storm warnings already issued have been very valuable to merchant shipping, and to the vessels of our navy. The new cables laid by the United States Government are very serviceable in this respect.

GAS ENGINE EFFICIENCY TESTS.—In a paper read at the recent Milwaukee meeting of the American Society of Mechanical Engineers, Mr. C. H. Robinson gives the results of efficiency tests of a 125-hp Westinghouse gas engine. The average thermal efficiency of the engine was 20.05, the highest being 23.24 per cent; the figures correspond to 171.66 and 226.13 B. T. U. per ihp per minute, respectively. The mechanical efficiencies corresponding to these tests were 79.39 and 89.05 per cent, respectively. The gas consumption per indicated horse-power became as low as 9.7 cubic feet, and per brake horse-power, 11.29 per cent, the averages for the tests with respect to these two items being 10.62 and 13.69 per cent, respectively. Tests were made to determine the distribution of heat in the engine. At the lowest horse-power of the series the percentages equivalent to indicated horse-power, the exhaust and the jacket, were 10, 32 and 58 respectively. At the highest horse-power (164 indicated) these figures became 26, 44 and 30 per cent.

BLUE-PRINTING BY ELECTRIC LIGHT.—Mr. H. G. Reist in a paper read at the recent Milwaukee meeting of the American Society of Mechanical Engineers gave an account of the arrangements employed in the General Electric works at Schenectady for blue-printing by electric light. The carriages supporting blue-printing frames are run under a metal hood a little larger in size than the printing frame, each containing two 5-ampere, 110-volt enclosed arc lamps. The lamps in turn are supported on a small trolley arrangement and are enclosed in white opal globes. The time required for printing is three or four times as long as with bright sunlight. The cost of making prints by electric light is smaller than by sunlight, owing to the fact that the labor employed in carrying out the former method can be utilized during the entire office hours, both summer and winter, and during cloudy days. Another advantage is that with the electric equipment blue prints may be put into the shop almost immediately after the completion of the tracing, regardless of the time of day.

FIELD MAGNET SHIELDS.—A patent granted June 11 to Percy H. Thomas relates to the protection of the coils of electrical apparatus from damage caused by sudden changes in static potential. The conducting shield is placed between the coil to be protected and any object having comparatively large electrostatic capacity, and is electrically connected to the terminal or lead through which the dangerous change in potential is transmitted to the coil. The entire bound charge will then appear on the shield, and thus entirely relieve the coil and protect its insulation from the strains to which it would otherwise be subjected. The illustrations show the device applied to a transformer, to an armature winding and to a magnet core such as may be used in arc lamps, in telegraph or telephone instruments or any other relations where such coils are ordinarily used. As applied to a transformer, the shield is placed between the primary and core, or between the primary and secondary windings, or both, and is electrically connected to one side of the primary mains.

LONDON UNDERGROUND.—A cable dispatch from London of June 1 says: The *Times* this morning has a practical and insistent editorial article on London's great need of electrical improvements, and the obstacles in the way of progress in that particular. These obstacles may all be expressed in the two familiar words "British conservatism," but they may be specifically reduced to muddled and antiquated laws, the ignorance and stupidity of concealment, the timidity of the Briton in the face of new ideas, and the long-established English custom of compensating oneself for discomfort by grumbling. Some time the Metropolitan & District Railway will be equipped with electricity, the new deep tunnels will be built, and the town will be properly lighted. The latest opponent of rapid transit is St. Paul's Cathedral. The Dean and Chapter of that venerable institution object to the new projected "tube" from Piccadilly to the city for fear that it will undermine the cathedral's concrete foundation. They declare that the spire of the famous Church of St. Mary-le-Bow in Cheapside, in which the Bow bells ring, is 23 inches out of the perpendicular because of the excavations for the existing two-penny tube, the only modern means of transit in London.

FLEECING SENDERS OF CABLE MESSAGES.—The subjoined is from the Philadelphia *Record*. It does not at all coincide with our own experience. In sending cablegrams from all over Europe we have never been fleeced in this way anywhere: "Americans who go abroad must expect to be robbed right and left," said a young man who recently returned from a brief European tour. "One expects to be held up for all sorts of tips, but when the beggars follow you home you can't help feeling a sort of admiration for their ingenuity. I went over on one of the Red Star line boats, and the first thing I did on landing at Antwerp was to go to the cable office and send a message to my mother, announcing my safe arrival. I paid the toll and thought no more about it until I got home, when, among my mail, I found a letter from the Antwerp operator, addressed in care of my mother, saying that through an error he had not charged me enough for my cablegram sent on such and such a date; that he had been obliged to pay the difference out of his own pocket, and as his salary was very small and he had a large family, and all that sort of thing, he felt sure I would reimburse him. The amount was a trifling one, and I did send him a foreign money order. I have since learned from experienced travelers that I had been made the victim of a systematic form of robbery, and that scarcely a cablegram is sent from the other side unless it is of a business nature, that is not followed by some such plea from the European operator."

ARMY AUTOMOBILES.—The British Government has instituted a prize competition for the best type of automobile for military purposes. Three prizes are offered: A first prize of $2,500, a second prize of $1,250, and a third prize of $100. The details of the competition are given in a notice in our advertising columns.

RAILROAD TERMINAL ELECTRIC SERVICE.—Construction is to be started this fall on a $3,000,000 passenger station in Chicago, which will replace the Van Buren Street structure now used by the Lake Shore, Rock Island and Nickel Plate railroad. All trains will be hauled into and out of the city by electric locomotives. Steam traction on the Rock Island road will end at Blue Island, and the trains of the Lake Shore and the Nickel Plate railroads will drop their locomotives at Englewood.

FRENCH CABLE PLANS.—A special cable dispatch from London of June 8 says: There is considerable energy in the latest French effort to secure the establishment of French telegraphic and cable service all over the world, free from English supervision. A bill now before the Chamber of Deputies approves the convention of last March of the Government with the French Cable Company for the laying of a number of lines. Recent events in the East and in South Africa have awakened France to a lively sense of the possibility that some day she might be without the means of quick communication with her colonies and the rest of the world. The original report of this week's Tien-Tsin incident seems to have strengthened the case. The British are accused of coloring facts to suit their own convenience.

THREE-PHASE ELECTRIC RAILWAY SYSTEM.—A patent granted June 11 to George Westinghouse, Jr., relates to the organization of circuits and conductors of a three-phase electric railway system. A continuous wire or cable supports two conductors, representing the two legs of a three-phase system. The supporting conductor may be connected to earth at intervals, and thus form part of the earth circuit and third leg of the system. Or the supporting conductor may, if desired, constitute in itself the third leg of the conducting system, in the latter case, of course, being entirely insulated; or it may be employed merely as a guard to the two conductors which it supports. If in case of a sectional railway it should be desired in any instance to make a more complete ground connection when the car is passing along a section, the supporting conductor may be connected with an electromagnetic contact device whereby, when a car is upon the corresponding section, a ground circuit from the supporting conductor will be completed.

BRITISH PACIFIC CABLE.—According to a recent consular report from Victoria, a surveying party has located the landing site of the British Pacific telegraph cable (which is to connect the Dominion of Canada with the Australian Confederation) on Kelp Bay, near Banfield Creek, 7 miles from the entrance to Barclay Sound, and something over 100 miles from Victoria. The location is described as admirably adapted for the purpose—a good harbor, 12 fathoms of water close to the shore, so that vessels of 10,000 tons can find safe anchorage. The harbor is landlocked, and has a bottom of ooze that it is said will furnish good protection for the wire. Work has already begun in England on the cable. It is to be 5834.5 miles in length, the longest yet constructed, and will be transported and laid in one ship, which is now being specially built for the purpose. The cable will run from Vancouver Island to Fanning Island, a distance of 3337 miles, before a landing is effected; thence to the Fiji Islands, thence to Norfolk Island, and thence to Queensland. The first installment of cable, including the sections from Queensland to Norfolk, Fiji, and Fanning Islands, is expected to leave England in January, 1902. The second and longest portion is to leave in August, 1902, go direct to Vancouver Island, and be laid from Barclay Sound to Fanning Island. According to the contract, the whole cable is to be laid and working by Jan. 1, 1903. Unforeseen disaster excepted, those engaged in the work believe this great enterprise, which will cost $10,000,000, will be completed at the date promised.

A MASSACHUSETTS MUNICIPAL PLANT.—Massachusetts makes another interesting contribution to the stock of public knowledge regarding municipal lighting plants, in the report from the manager of such a plant in the city of Taunton. It appears, according to the *New York Evening Post*, that the plant is nearly worn out, that the buildings are in danger of tumbling into a river during any heavy storm, that the machinery is out of date, and that the power needed to run it cannot be secured with the material on hand. In other words, the city must now build practically a new plant, or else go out of the lighting business. What renders this report the more striking is the fact that this Taunton experiment has for years been held up as an example of the successful municipalization of "public utilities"—a plant which not only furnished light for the street lamps and the city offices, but also for the offices and residences of citizens, and at the same time was "operated at a profit." The truth was that no account had been taken of the steady depreciation of the plant, and of the approaching necessity for large expenditures to keep it running. The Boston *Advertiser* says that there is nothing exceptional in this experience; that other cities which have been showing bookkeeping "profits" have not been keeping their plants "up-to-date," and are already beginning, or will soon begin, to feel the effects. It maintains that the only way to figure out the municipal lighting plants in Massachusetts as profit-making institutions is by ignoring the item of "depreciation of plant," which no private company would ever think of doing.

LETTERS TO THE EDITORS.

Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs.—In a popular article on "Wireless Telegraphy," by a well-known physicist, that appeared in the current number of one of the best magazines, there is one point brought out that appears to me to lack the support of facts. The article states, in substance, that the electromagnetic radiation goes out in straight lines, similar to the light of a candle, and consequently conducting bodies intervening will screen off the effects from the receiver. Owing to the curvature of the earth and the fact that saltwater is an excellent conductor it will not be possible to signal a greater distance than that at which an air line connecting the tops of the vertical wires would be tangent to the earth.

The first point mentioned, that the radiation is in straight lines, is the one that, to me, appears to be doubtful, and as all that follows in the above hinges on that statement (there is no question but that the radiation will not penetrate the water) we can turn our attention to a consideration of it. The greatest distance that Mr. Marconi has sent a message, so far as I know, is 200 miles, from the Isle of Wight to Lizard Head. A simple calculation will show that in order to have the air line connecting the tops of his vertical wires he would have to use poles about 6280 ft. high. The ones he actually used, I believe, were but 150 ft. in height. Of course, the base of these poles may have been a hundred feet or more above sea level, but allowing for that we still have an enormous discrepancy.

If this radiation does not go through, it must go around, and the theory, proposed by several writers, that the function of the earth connection is to supply a conductor between the two stations along which the waves could slide, seems to fit the case. It is very fortunate that such is, apparently, the case, as otherwise long-distance signaling would be out of the question.

Accepting this theory, for the lack of a better one, the problem of the practical telegrapher resolves itself into one of producing more intense radiation and in inventing a better detector to make transatlantic work a reality.

The coherer at present is probably as sensitive as it can well be used in practice, and improvements in the receiving station can best be made in the arrangement of the vertical wires and auxiliary apparatus.

S. M. KINTNER.

ALLEGHENY, PA.

The Automobile Club's Endurance Test.

To the Editors of Electrical World and Engineer:

Sirs.—Referring to the proposed test of the Automobile Club of America from New York to Buffalo next fall there seems to be some misunderstanding on the part of the press, as to the facts in relation to the Technical Committee of the Automobile Club, in relation to this matter. The Technical Committee prepared all the general rules and regulations for this test, and turned them over to the Board of Governors, who have approved them. The committee then decided, as five out of the eight members of the committee were man-

ufacturers and would practically have entries in the test, that in order to avoid criticism it would be wiser to request the club to put the actual charge of running the test under the supervision of a special committee, free from any manufacturers' interest, in order to avoid criticism on the part of any manufacturer, who was or was not represented on the committee. In compliance with the request of the Technical Committee, made at the suggestion of the Technical Committee, and at the special request of the chairman thereof, the Board of Governors have appointed a committee of three to take charge of it, who are entirely disinterested from any manufacturers' interest. This committee is composed of Messrs. W. M. Power, W. E. Scarritt and Harlan W. Whipple.

NEW YORK CITY. C. J. FIELD,
Chairman Technical and Contest Committee.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS

Polyphase Working.—EBORALL.—A communication in which he makes some corrections in the report of his last lecture (which was abstracted in the Digest last week). The current densities given apply to the stator conductors only. In these the full-load current density will be between 1100 and 1500 amperes per square inch for the usual standard motors. The peripheral speed of rotors will not exceed 6000 ft. per minute with standard motors. The ampere-wires per inch of stator core at full load will lie between 300 and 450 for standard motors between 5 and 100 horse-power. These figures must, of course, be used in conjunction with the other data given, and are only to be taken as a guide when getting out the preliminary design. The flux densities quoted do not apply to hole-wound motors, only to slot-wound machines. Satisfactory power factors and good starting performances can be attained with induction motors only when the air-gap length, and consequently the magnetic leakage, is small. These small air-gaps may be a source of weakness in polyphase traction motors unless the bearings are carefully and frequently inspected. Naturally the shafts and bearing supports must also be specially stiff for work of this kind. Earthing the middle points of the star-connected generators and step-down transformers was mentioned by him as being common practice, as is also the modification of this method of working, namely, the use of a fourth wire of small section instead of the earth connection. The object is, of course, either to help balance the system, the neutral wire carrying only the out-of-balance current, or to work the lighting load at a smaller pressure than the motor load, or to make use of both these advantages. In factory installations, for instance, it is frequently convenient and economical to work in this way, running lights at 200 volts and motors at 350 volts.—Lond. *Elec.*, May 3.

Converters.—COLLES.—A continuation of his very long and well illustrated serial on rotary transformers, their history, theory and characteristics. This part deals with the inductorium which is defined "as a self-contained" induction coil or series of coils, one of whose sides is connected to a commutator, adapting it to mediate between alternating or polyphase and continuous currents. By 'self-contained' is meant that it is not acted on by external magnetic fields, and it is hence, in general, stationary." He gives a review of the development of this type.—*Frank. Inst.*, June.

REFERENCES.

Calculation of the Stray Coefficient of Induction Motors.—JONAS.—A mathematical article in which he develops a formula for the stray coefficient of an induction motor, the stray coefficient of the stator and that of the rotor being each defined as the ratio of the e. m. f. of the stray field to that of the air field. He has used his formula in the predetermination of induction motors and found good agreement between calculation and measurement. Three numerical examples are given.—*Elek. Zeit.*, May 30.

Windings of Drum Armatures.—BURNIE.—An article on the winding of closed coil drum armatures. The winding formulæ commonly used for drum armatures are so numerous and so different that it is very difficult to memorize them all. It is possible, however, to get all these formulæ from one single expression obtained by considering the total number of conductors passed over in all the winding steps from a starting point until one arrives again at the same point. The article is, however, too mathematical to be abstracted.—Lond. *Elec.*, May 31.

LIGHTS AND LIGHTING.

Cheap Device for Darkening Incandescent Lamps.—STERN.—An illustrated article in which he suggests a cheap method for decreasing the light given out by an incandescent lamp, as is sometimes desired in hospitals, etc. To obtain normal illumination the ordinary lamp burns at its rated pressure. To obtain less illumination, another lamp is connected in series with the main lamp. The voltage and the candle-power of this auxiliary lamp are so chosen that it burns at normal voltage when in series with the main lamp. He shows how to calculate the best type of auxiliary lamp for this purpose. If the main lamp is a 120-volt 16-cp lamp, the auxiliary lamp ought to be a 60-volt 5-cp lamp. The switch used in connection with this device is very simple.—*Elek. Zeit.*, May 30.

REFERENCES.

Incandescent Lamp Factory.—An illustrated article on the plant of the Incandescent Electric Lamp Co. in Hammersmith, Great Britain, where the Robertson lamp is made. The different steps of the process of making this lamp are described.—*Lightning*, May 30.

Searchlights.—PERKINS.—An illustrated article on the use of the modern searchlight in the navy.—*El'ty*, June 5.

POWER.

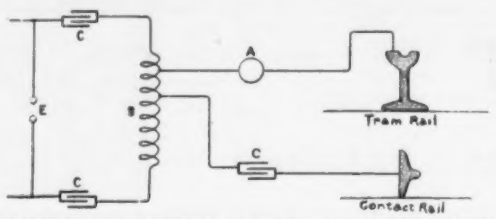
Design of Electric Plants.—B. J. ARNOLD.—An abstract of a lecture delivered before the Engineering College of the Univ. of Ill. He discusses the choice of location of the power house, the choice of the electric system, speaks of the development of sub-station electric supply, and the best equipment of steam plant. From 15 to 25 per cent in full may be saved by the condensing of the exhaust steam. The efficiencies of the several parts of a steam power plant are stated as follows: Steam boilers, with Illinois coal, from 58 to 65 per cent, and with Pennsylvania coal from 70 to 72 per cent; mechanical efficiency of steam engines from 85 to 92 per cent, according to type and manufacture. He also referred to the planning of switchboards and to the drafting of specifications.—*West. Elec.*, June 1.

Polyphase Equipment of Factories.—WYLD.—An abstract of a paper read before the Birmingham section of the Brit. Inst. Elec. Eng. He gives some information about polyphase plants in English factories, and describes at some length the installation of the Patent Shaft & Axletree Co.'s works at Wednesbury, where there is a plant of 420 horse-power, consisting of two three-phase generators at 210 horse-power each, and some 30 motors, varying in size from 50 horse-power to 5 horse-power, the small ones being in use on traveling cranes. Since the plant was started over a year ago, it has worked most successfully, and the economy has been very marked. He also gives a list of examples of polyphase equipments in factories in different countries. He gives information about the kind of factory, the polyphase system used (nearly all use the three-phase system), the frequency, the total horse-power of the generating plant, and the number and size of motors and how employed. He also gives a brief table of polyphase plants in use in the different countries. There are 105 plants, aggregating 68,000 horse-power.—Lond. *Elec.*, May 31.

REFERENCE.

British Power Distribution Schemes.—The first part of a series of articles giving maps, with additional descriptions, of electric power distribution and transmission schemes before the British Parliament during the current year.—Lond. *Elec.*, May 31.

Localizing Insulation Faults in Conduit Systems.—A. Z.—An illustrated description of a method devised by Claude and de Villiers of the French Thomson-Houston Company. It is based upon the fact that the solid conductors offer a considerable impedance to high frequency currents. This is said to be the first industrial application of high frequency currents. On an ordinary tram car a high frequency generator is installed, for instance, a Ruhmkorff coil, the



LOCALIZING INSULATION FAULTS IN CONDUIT SYSTEM.

secondary terminals of which are connected to a spark-gap *E*, and to two condensers *C C*, which are connected together by solenoid *S*. At each spark the condensers are discharged and an oscillating high frequency current is produced. Two points of the solenoid are connected through a hot-wire ammeter to the frame of the car, i. e., to the tram rails or the earth, the other through a condenser *C* to the conduit. The latter condenser holds off the direct current of the supply, and enables one to localize a fault during the regular service. When the car runs along the line the current indicated by the ammeter is practically zero, as long as the car is at a distance of more than 20 or 30 meters from a fault, as the circuit of the high frequency current, comprising a great length of both conduit and track rails, has a very great apparent resistance. But as soon as the car approaches a fault, the impedance of the circuit is reduced to that of the connecting wires, of a short length of rails, and of the fault, the ammeter indicates an appreciable current which becomes a maximum when the car is over the fault. Unfortunately, only short circuits which are practically dead can be localized by this method, but it is hoped that it will be possible to increase its sensitivity.—*L'Ind. Elec.*, May 25.

Earth Return Currents of Tramways.—An editorial on the earth as an ordinary electrical conductor. The conclusions drawn from the assumption of the earth acting as an electrolyte regarding the damage done to gas and water pipes, are said to be numerically wrong. Long abstracts are given from a paper of Claude (abstracted in the Digest last year), who found that the earth acts to a very large extent as an ordinary conductor, though partially as an electrolyte and that, generally speaking, only a small proportion of the current leaving the track rails enters into neighboring metallic pipes. Reference is also made to a United States official report on electrolysis in the District of Columbia.—Lond. *Elec.*, May 31.

Automobiles in Paris.—COTTRELL.—An illustrated description of the electric automobiles of the Compagnie Generale des Voitures, of Paris. The style of cab adopted and now in use has a battery box "containing 43 elements of the Julien type, with Plante modifications. The capacity of a battery is from 37 to 44 miles at a speed of 9 miles per hour, without being absolutely exhausted. The motors are of the Lundell-Johnson type, with four poles, excited in series, and two collectors. The winding is double, on both magnets and fields, so that, by coupling the windings in series or in parallel, different speeds can be obtained. The cabs are lighted by electricity, the internal lighting being afforded by a 5-cp lamp fitted to the center of the roof. The charging station for the batteries is described in detail.—*West. Elec.*, June 8.

Automobile.—An illustrated description of a new two-place "electrolette" of the Krieger type. The battery is of the Fulmen type, and allows a run of at least 65 miles on a single charge. There are two 3-hp motors. The total weight of the automobile is 1700 lbs., of which 800 lbs. are for the battery and 220 lbs. for the motors.—*Sc. Amer.*, June 8.

REFERENCE.

Calculation of the Current Distribution for Electric Railways.—PFORR.—An article in which he starts from the statement that electric railways, consuming unequal quantities of current at different points, and taking off the same from the supply circuit at certain given feeder points, have a certain analogy with a long beam of a bridge resting at given points upon piers. He applies the methods of analytical mechanics for calculating the distribution of the load upon these different pillars, to the case of electric railways and develops a graphical method for determining the distribution of the load.—*Elek. Zeit.*, May 16.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Monocyclic System in Madrid.—BASWITZ.—An illustrated description of the new electric station of the Inglesa of Madrid. He begins with the statement that the use of electric energy, especially for lighting, is not developed as much in any country as it is in Spain, with perhaps the single exception of Switzerland. There are no franchises required in Spain for laying cables, etc., there is therefore great competition. Madrid has 15 different supply companies, of which the Inglesa is one of the principal. The Union Elec. Co., of Berlin (affiliated with the General Electric Co., of this country), has recently installed a new plant for this company. As there is a large area to be supplied, an alternating-current system was necessary and the monocyclic system was chosen, in order to be able to connect motors more readily. There are four monocyclic generators, each giving 450 kilowatts at 125 r. p. m. and inductionless load, the frequency being 50. The voltage in the station varies between 2040 and 2200, according to the load. The sub-stations, cable network, etc., are described. The voltage at the consumer's terminals is 100.—*Elek. Zeit.*, May 23.

Electric Installation of a Coke Plant.—HARTMANN.—An illustrated description of the electric installation of the coke plant of the collieries in Orlan-Lazy in Austrian Silesia. The current is used for lighting and power purposes. The steam plant contains three generators running at 145 revolutions, and giving three-phase currents at 370 amperes per phase at 330 volts, the frequency being 42. In the coke plant itself all motors are run at 330 volts, while for transmission to more distant plants the voltage is transformed up to 3000. The incandescent lamps are supplied with 100-volt alternating current from transformers, while the voltage reduction for the arc lamps is made by individual small transformers on the lamp poles.—*Elek. Zeit.*, May 30.

Electric Installation of a Bank Building.—An illustrated article on "Electrical features of the Chicago National Bank." All the current used for light and power is obtained from a supply company. The circuits are carried to a switchboard upon which are mounted one 400-ampere, three-pole switch for lighting and one 300-ampere, two-pole switch for power. All lighting is carried on the Edison three-wire system, with 110 volts between the neutral and the outside wires. The power service is cared for by 220-volt, two-wire circuits. Electric power is used in connection with the heating, ventilating and sewerage systems.—*West. Elec.*, June 1.

ELECTRO-PHYSICS AND MAGNETISM.

A Condenser in Parallel with an Inductive Circuit.—PERREAU.—An investigation, by a graphical method, of the case of an alternator supplying current to an inductive circuit and a condenser connected in parallel to this circuit (this is a first approximation of the case of an alternator supplying current to an inductive circuit through underground cables, which represent a certain capacity in parallel). He shows that in order to pass a current of given intensity through a supply network one may, by placing a condenser in parallel, use a lower e. m. f. than required without that, and that a smaller current will then flow in the alternator so that the loss by Joulean heat is smaller. The action of the condenser may be compared with that of a transformer which receives an e. m. f. and a current and gives out a stronger current at a smaller e. m. f.—*L'Eclairage Elec.*, May 4.

Velocity of Electric Waves Along Wires.—BARKLA.—An account of experiments in which the Rutherford detector was used in measurements of the velocities along wires of various diameters and materials. He first made experiments with copper wires of different diameters, and found that the wave length decreases very slightly with decreasing diameter, further that the diminution of velocity in the finer wires is greater with higher frequency. The effect of increasing the specific resistance of the material of the wire was shown by comparing the wave lengths, corresponding to the same frequency, along wires of the same diameter, but of different material. The comparison was made between platinum and copper, the specific resistances of which are in the ratio of 7:1 approximately. The velocity of electric waves along platinum wire of diameter .0158 cm. was less than the velocity along copper wire of the same diameter by about 0.4 per cent.—*Phil. Mag.*, June.

Mechanical Movements of Wires Produced by Electrical Discharges.—VIOL.—When oscillating discharges are sent over wires the wires become luminous under certain conditions and apparently show stationary electric waves. Various investigators have described this phenomenon and have measured the wave lengths, which they have considered true wave lengths due to the capacity and self-induction of the circuit. The present author, however, considers that these luminous effects are merely mechanical vibrations due to the electric spark of a much lower period than those which would arise from true electric oscillations, and that the nodes and ventral segments are rendered visible by a species of negative brush discharge along the vibrating wires.—*Ann. der Physik,* 1901, No. 4; briefly abstracted in *Am. Jour. of Sc.,* June.

Oscillatory Discharges.—RUSSELL.—A communication on the problem of getting an oscillatory discharge from a condenser and of inventing a simple way of altering the period of the oscillations. Mizuno has shown that by simple shunting the condenser by a non-inductive resistance he can vary the frequency of the oscillations throughout a wide range. Further, that if the circuit is non-oscillatory to start with, it can be made oscillatory by shunting the condenser. The only drawback to this method is that the damping factor is always increased and, hence, that the free vibrations die away more rapidly. The present writer suggests another method by which the damping factor can be diminished so that he can actually increase the number of the free oscillations, whilst being able to alter the frequency between wide limits. His method is to wind a secondary coil of wire around the inductive coil and to vary the frequency by altering the resistance between its terminals. As the voltage can be reduced by this means there will be less risk of the resistance coils being broken down through sparking. He gives an outline of the theory of this method. It shows that this method of altering the frequency is perfectly feasible, and if the quantities are properly chosen the damping can be very considerably diminished.—Lond. *Elec.,* May 31.

Magnetic Properties of the Alloys of Cast Iron and Aluminum.—RICHARDSON and LOWNDS.—A second illustrated paper on this subject. They investigated in what way the hysteresis loss, between given limits of the field strength, is connected with the temperature for a specimen containing 3.64 per cent of aluminum. The hysteresis loss at first diminishes as the temperature rises. It then increases and reaches a maximum value at about 550 degs. C., which temperature is about 80 degs. higher than the temperature of maximum induction. On further heating, it falls off rapidly and becomes negligible at about 700 degs. C. The magnetic properties of the specimen depend largely on its previous history. There is no essential difference between the behavior of this specimen during heating and cooling, except near the temperature of minimum permeability. An abrupt increase in the permeability takes place at 652 deg. C, during heating, followed by an equally abrupt diminution on further heating. This abrupt change in the permeability is more marked with falling than with rising temperatures. Continued heating and cooling diminish the permeability of this specimen, probably due to disintegration. The curve connecting the temperature of minimum permeability and the percentage of aluminum for the three specimens investigated is a straight line. The microscopic examination of the specimens shows the presence of crystals.—*Phil. Mag.,* June.

Hysteresis of Nickel and Cobalt in a Rotating Magnetic Field.—BEATTIE.—An account of experiments, the results being given in tables and a diagram. The material to be examined, in the form of a thin circular disk, was placed in a wooden box, and this box was suspended between the poles of an electromagnet. When the electromagnet was rotated slowly so as to avoid the production of eddy currents, the suspended system experienced a couple and was in consequence twisted through an angle proportional to the hysteresis loss, the two quantities being connected by a formula which does not contain the speed of rotation. For nickel he found that for an intensity of about 340 c. g. s. units the hysteresis loss reaches a maximum value of nearly 10,000 ergs. per c. c. per cycle. As the intensity is increased from this point to the highest value attained, viz., 475 c. g. s. units, the hysteresis loss rapidly falls off. The latter portion of the curve is sensibly a straight line, and if it were to retain this character over the unexplored region, the hysteresis would disappear entirely at an intensity of 500 c. g. s. units, which is about equal to the saturation intensity of nickel. The curve obtained by him for cobalt shows the same general character, but the maximum hysteresis loss—36,000 ergs per c. c. per cycle—occurs at an intensity of 700 c. g. s. units, and is very much greater than for nickel.—*Phil. Mag.,* June.

REFERENCES.

Conductivity for Heat and Electricity, Heat-Capacity and Thermo-Electric Power of Certain Metals.—JAEGER and DIESSELHORST.—The complete report on their work, of which preliminary accounts were noticed before in the Digest. Elaborate mathematical discussions of the sources of errors are given, also full details of the precautions that must be taken in the experiments, and of the corrections that must be applied in the calculations. The numbers given in their former papers have been revised.—*Phys. Techn. Reichsanstalt, Wiss. Abb.,* 3, pp. 269 to 424; briefly noticed in *Science Abstracts,* May.

Conductivity of Hydrogen and Carbonic Acid Gas.—TOWNSEND and KIRBY.—An account of a series of experiments on conductivity produced in hydrogen and carbonic acid gas by the motion of negatively charged ions.—*Phil. Mag.,* June.

Terrestrial Magnetism.—The May number of the journal of this name contains the following articles: The conclusion of Exner's summary of the results of recent investigations in atmospheric electricity; a second paper of Bauer on the physical decomposition of the earth's permanent magnetic field, dealing with the composition and characteristics of the uniform magnetic field; a summary of magnetic work at Bombay Observatory in 1897; a paper by Hazard, on the magnetic work of the Norwegian North Polar expedition 1893 to 1896; a summary, by Bauer, of results of recent comparisons of magnetic instruments; an article on Schuster's researches on the solar rotation and the lunar period of the earth's magnetism; and a biographical sketch, with portrait, of William Ellis.—*Terr. Mag.,* May.

ELECTRO-CHEMISTRY AND BATTERIES.

Electro-Chemical Action.—C. J. REED.—A continuation of his Franklin Inst. paper. He defines the polarization of an electro-chemical cell as electro-chemical fatigue. It is caused by the exhaustion of the re-agents at the loci of the electro-chemical action (terminals of the electrolyte or electrolytic chain), and their consequent displacement by other substances which produce a different and more electrothanic or less electrogenic reaction. When the substance in the very thin molecular layer on the surface of the electrodes is exhausted, polarization sets in, if diffusion does not bring new substances to this layer. Convection is also very important in practice. In all ordinary cases of electrolysis convection is the principal cause of the transportation of matter to and from the electrodes. He states the law of maximum electrogenesis, when two or more independent electrogens in the same electro-chemical system, are equally accessible in parallel to the electro-chemical circuit, they are successively exhausted in their order of maximum electrogenic power, and when two or more independent electrothans in the same system are equally accessible in parallel to the same electro-chemical circuit, they are successively exhausted in their order of minimum electrothanic power. Or, in other words, when several independent electro-chemical reactions in the same system are equally accessible in parallel to the same electro-chemical circuit, they are successively exhausted in their order of maximum evolution or minimum absorption of electrical energy. Polarization occurs at the anode as well as at the cathode. In consequence of the popular belief that polarization can occur only at the cathode, the reagents used at that terminal have received the name "depolarizers," because while they last there is no polarization. In all electro-chemical systems these cathode reagents are "oxidizing agents," or, more broadly speaking, chemical compounds, one or more components of which suffer diminution of chemical valence in an electro-chemical reaction, or they are chemical elements whose valence becomes electro-negative in an electro-chemical raction. The anode reagents are "reducing agents," i. e., substances, whose chemical valence suffers an increase, or whose electro-negative valence becomes zero or positive. He then discusses the speed of electro-chemical action. The speed of continuous electro-chemical action without polarization may generally be materially increased by imparting a rapid mechanical motion to the electrolytes to assist diffusion.—*Jour. Frank. Inst.,* June.

Edison Battery.—An editorial note refuting the extravagant prophecies of newspapers regarding the general replacement of the horse by the Edison battery for traction. Nickel, which is used for the positive plate, is neither low in price nor available in unlimited amounts for commercial use. The present price of nickel is 50 to 60 cents per

pound, which restricts the use of nickel for the treatment of steel to high-class work. The Edison battery seems, by its price, restricted to special purposes.—*Eng. News,* June 6.

Equilibrium Between the Different Oxidation States of a Metal.—ABEL.—A very long paper giving the results of a research on the equilibrium between the different oxidation states of the same metal in the case of both mercury and copper. Among many other things he found that the electrolysis of solutions of copper sulphate which were in equilibrium with copper did not give that increase of weight of cathode and diminution of weight of anode when small current densities are used, which is required by theory. The amount of deposited copper was always too small. These differences depend on the concentration of the sulphuric acid. It is probable that, with these small current densities, a dissolving action is superimposed on the pure electrolytic action, which is perhaps caused by a reduction of the sulphuric acid due to the electric current and a consequently stronger formation of complex bodies from the cuprous ions, whereby the equilibrium is disturbed and fresh copper must go into solution. The copper voltameter can, however, be made to an exact, if somewhat inconvenient, measuring instrument for small current densities, under the following condition: Separation of anode and cathode, treatment of the copper sulphate solution before the commencement of the measurement with dilute acids, and working in a stream of hydrogen gas. The accuracy of the copper voltameter increases with diminution of temperature.—*Zeit. f. anorgan. Chemie,* v. 26, p. 361; abstracted at some length in *The Elec. Chem. and Met.,* May.

Application of Electrolysis to Organic Compounds.—HEWITT.—A continuation of his serial. He first deals with alcohols. The preparation of alcohols by electrolysis is probably not feasible, neither is the conversion of alcohols into other substances by electrical means likely to be of service in many cases, although the electrolytic production of chloral from ordinary ethyl alcohol is now carried out technically. Electrolysis has been proposed for the purification of alcohol, and the question of using ozone for the ageing of wines has attracted some attention. He also deals with acids and aldehydes and ketones. One aldehyde of technical importance is produced by an electrolytic method, viz., chloral. A still is divided by a diaphragm. In the anode space is a hot concentrated solution of potassium chloride. The anode itself is of carbon, and movable, so as to act as stirrer at the same time. The cathode is of copper. Electrolysis is carried out at 100 degs. C., alcohol being allowed to flow into the anode space where, in contact with the nascent chlorine, it is converted into chloral; 50 grams of chloral are produced per horse-power-hour.—*The Elec. Chem. and Met.,* May.

Electrolytic Purification of Glycerine.—A note stating that crude glycerine containing various sodium and potassium salts, can be purified by electrolysis, whereby these salts are decomposed while the glycerine is not attacked. The cathode consists of mercury lying at the bottom of the electrolytic cell. An amalgam is formed, which is subsequently treated. The nature of the anode depends upon what salts have to be removed, as it is essential that insoluble compounds should be formed. When the electrolysis has been completed, run off the pure glycerine, which will be turbid, but will clarify on standing.—*The Elec. Chem. and Met.,* May.

REFERENCES.

Comparative Data of Storage Batteries. —Nearly three pages of tables of comparative data of a number of batteries, chiefly those exhibited in Paris last year or those which took part in the Automobile Club competition of 1899. Each table gives five facts about three types of cells of the same capacity for each make, the capacities ranging between 25 ampere-hours and 6000 ampere-hours. The three types of cells selected are intended to be normally discharged in 10 hours, 5 hours and 1 hour, respectively. The five facts given are: The weight of electrodes per ampere-hour in grams, the total weight per ampere-hour in grams, the volume per ampere-hour in c. c., the discharge rate in ampere per kgr. of plates, the price per ampere-hour in pence.—*The Elec. Chem. and Met.,* May.

Conductivities of Aqueous Solutions of Alkali Chlorides and Nitrates.—KOHLRAUSCH and MALTBY.—The official report of a very exact investigation. The conductivities here determined will serve as standard, since every possible source of error has been allowed for or eliminated. The results are given in tables and diagrams.—*Phys. Tech. Reichsanstalt Wiss. Abb.,* 3, p. 155, 1900; noticed in *Science Abstracts,* May.

Electrolytic Production of Alkalies and Chlorine.—J. B. C. KERSHAW.—An illustrated article on the non-diaphragm mercury processes for the production of caustic alkalies and chlorine. He briefly characterizes the Castner cell, and gives some information regarding plants in which this cell is used. The Solvay cell is also described and illustrated. Some notes are given on the plants in which the secret process of the Elektron Co., of Griesheim, is used.—*El'ty,* June 5.

Electro-Chemical Laboratory.—HUTTON.—A detailed illustrated description of the electro-chemical laboratory at Owens College, Manchester.—*The Elec. Chem. and Met.,* May.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Lux Watt-Hour Meter.—An illustrated description of the Lux meter for direct and alternating currents. It is a motor meter and has a motor, free from iron, the energy of which is consumed by a brake disk rotating between permanent magnets. The motor consists of two solenoids, supplied with the main current, and of an armature in shunt. The meter differs from other meters of the same type, especially in that it has instead of the ordinary drum armature, an armature with open circuit winding, like in the Thomson-Houston arc light machines. The advantages of this feature are pointed out. The meter can be used as well for direct current as for single-phase and polyphase alternating current. The makers guarantee that the errors are below 4 per cent, between 10 and 100 per cent of full load. The motor starts below 1 per cent of full load.—*Zeit. f. Beleucht,* May 10.

REFERENCES.

Watt-Hour Meter.—HOLDEN.—A long illustrated paper read before the Brit. Inst. Elec. Eng., in which he gives a detailed description of his watt-hour meter, which was described and illustrated in the Digest, Sept. 15, 1900.—Lond. *Elec.,* May 24, 31.

Wehnelt Interrupter.—LAMPA.—An account of an experimental investigation of the question why the Wehnelt interrupter is less efficient when the smaller electrode is negative than when it is positive. His experiments are made with a coherer circuit containing a galvanometer.—*Akad. Wiss. Wien. Sitz. Ber.,* 109, IIa, p. 891, 1900; abstracted in *Science Abstracts,* May.

Caldwell Interrupter.—RUHMER.—An illustrated communication in which he describes the results of experiments which he has made with a Simon interrupter (known in this country as Caldwell interrupter), and with a new form modified and improved by him.—*Elek. Zeit.,* May 30.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Syntonic Wireless Telegraphy.—MARCONI.—The conclusion of his illustrated paper, the first part of which was abstracted in the Digest last week. He can connect to the same vertical sending wire, through connections of different inductance, several differently tuned transmitters, and to the receiving vertical wire a number of corresponding receivers. Different messages can be sent by each transmitter connected to the same radiating wire simultaneously, and received equally simultaneously by the vertical wire connected to differently tuned receivers. A further improvement has been obtained by the combination of the two systems. In this case the cylinders are connected to the secondary of the transmitting transformer, and the receiver to a properly tuned induction coil, and all circuits must be tuned to the same period. The record distance over which signals have been sent through space without wires, is 186 miles. He gives a list of the commercial wireless telegraphy stations in permanent working order. They are all between stations on the seacoast or between such stations and steamers. He has lately tried to ascertain how near a tune transmitter which is radiating waves of a certain frequency, must be to a receiver tuned to a different frequency in order that the said receiver shall be affected. He finds that if he was working with oscillations which differ "very considerably in period," a transmitter capable of sending signals 31 miles to a tuned receiver will not affect a non-tuned one at 50 metres. If the periods of oscillation of the two tunes are more similar to each other, then the non-tuned receiver may be affected even at several kilometers. He finally makes some remarks about Slaby's work (which was described at some length in the Digest). He finds that the information given in Slaby's paper is very incomplete, and he criticizes some special points. He tried Slaby's arrangement without success, perhaps because he worked over too large a distance and used too small a vertical wire. He has come to the conclusion that the days of the non-tuned system of wireless telegraphy are numbered. An account is also given of the discussion which followed.—Lond. *Elec.,* May 31.

Testing Large Transformers.

BY JOHN S. PECK.

THE distinction of being the "Largest in the world" belongs at the present time to seven Westinghouse 2250-kw (3000-hp) transformers recently installed by the Cataract Power & Conduit Company, of Buffalo, N. Y.

The transformers are arranged for delta connection on both high-tension and low-tension windings, forming two groups of three each, one transformer being held as a reserve unit. The transformers are placed in a sub-station near Buffalo, for reducing the voltage of the Niagara Falls transmission circuit from 22,000 to 11,000 volts, for distribution through and about the city, as the use of 22,000 volts on the underground system in Buffalo is not considered feasible.

The winding is made up of a number of thin coils, which are placed side by side, the primary and secondary being frequently interlaced in order to insure close regulation with loads of all power factors. Numerous ducts are provided between the coils, permitting a free circulation of oil through all parts of the winding, and precluding the chance of any local heating. The iron laminations lie in a horizontal plane, and are also provided at frequent intervals with ventilating ducts.

The case is of riveted boiler iron, with all seams and rivet heads thoroughly caulked. The case rests upon a cast-iron base, and is provided at the top with a cast-iron cover. Two large manholes in the cover permit an easy inspection of the interior of the transformer and admit of ready access to the terminal blocks.

For cooling the oil, water is circulated through four spirals of brass tubing, which are placed inside the case below the surface of the oil. The four spirals are connected in parallel so that in case one should become disabled it may be cut out.

For indicating the temperature of the transformer, a "Standard" thermometer is fastened in the side of the case so that the end of the thermometer is immersed in the oil. This arrangement not only affords a means of determining the temperature of the oil at all times, but is so arranged that should the temperature at any time exceed a certain predetermined value, a battery circuit will be closed by the thermometer and a gong sounded, thus immediately attracting the notice of the attendant. An oil gauge is also provided to show the height of the oil in the case, and a large valve is placed at the lower end of the case so that the oil may be quickly withdrawn.

The terminals from the different coils are carried to marble terminal blocks placed above the transformer, but below the surface of the oil. The line leads are carried in at the top of the case through suitable bushings to the proper contacts on the terminal boards.

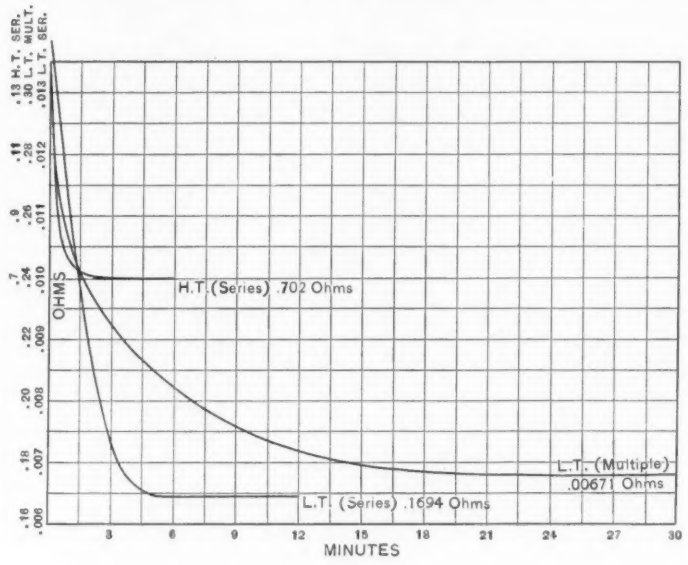


FIG. I.—CURVES.

Although these transformers are intended primarily for use in lowering from 22,000 volts, three-phase, to 11,000 volts, three-phase, they are so arranged that they may be connected for a number of other voltages; thus, the low-tension winding is arranged for either 2200 or 11,000 volts and the high-tension winding for either 11,000 or 22,000 volts. The windings are so arranged that the transformers may be used for the Scott two-phase-three-phase connection, or for three-phase to three-phase transformation with delta connection. A number of taps are brought out from the windings so that voltages approximately 5 per cent higher or lower than those given above may be obtained.

As the e. m. f. of the generators at Niagara Falls is 2200 volts two-phase, the transformers can be used at the power houses as raising transformers, stepping up from 2200 volts ,two-phase, to 11,000 or 22,000 volts, three-phase, or they may be used as reducing transformers at any point on the line for lowering from 11,000 or 22,000, three-phase, to 2200 volts, two-phase or three-phase. These different combinations of voltages and phases are easily made by

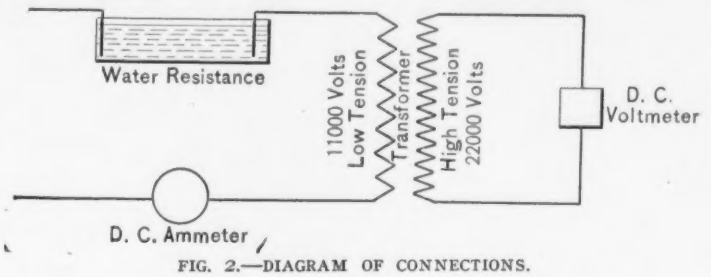


FIG. 2.—DIAGRAM OF CONNECTIONS.

simple changes on the terminal blocks of the transformers.

The high guarantees of performance under which these transformers were made were shown by actual tests to have been fulfilled, with very comfortable margins. The table below gives the guaranteed performances, also the values which were actually obtained. In all cases the average obtained from the seven transformers is given:

EFFICIENCY.	Full load.	¾ load.	½ load.	¼ load.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Actual	98.65	98.58	98.33	97.2
Guaranteed	98.40	98.40	98.20	97.0

REGULATION.	Non-Inductive load.	Load having 80 per cent. power factor.
Actual	0.76	1.8
Guaranteed	1.10	3.0

TEMPERATURE.—*Rise of coils as measured by increase in resistance.*

Actual	28.7 per cent.
Guaranteed	40.0 per cent.

All transformers stood the following tests:

(*a*) 45,000 volts applied for one minute between high-tension and low-tension windings and between high-tension winding and core.

(*b*) 22,500 volts applied for one minute between low-tension winding and core.

(*c*) Two and one-fourth times normal voltage applied to the low-tension winding for 30 minutes, giving a maximum of 49,400 volts on the high-tension winding.

In making the resistance measurements of the windings some interesting phenomena were observed. When these measurements are made it is necessary, for reasons which will be explained later, to short circuit one winding while the other is being measured. It was found that resistance measurements taken at different times did not check with each other. This phenomena had been previously observed on large transformers, but never before to such a degree.

On one transformer after the measurements had been completed and it had been standing for several minutes entirely disconnected from the circuit, the testers were greatly surprised to draw a heavy arc upon breaking the short circuiting connection. A consideration of the actions which occur in the transformers under the conditions of measurement, will make clear the reason for these peculiarities.

The resistance was measured by the drop-in-potential method. A direct current was passed through the winding and the drop taken with a voltmeter. From the current and voltage readings the resistance was calculated. A 110-volt storage battery circuit was used, the current in all cases being approximately six amperes. With this current the drop through the windings was in most cases considerably less than one volt, so that it was necessary to insert a high-resistance in series with the winding.

When a direct current is sent through a transformer winding a magnetic field is induced in the iron. Slight variations in current will cause variations in the strength of the mag-

netic field, which may in turn induce high e. m. f.'s in the transformer winding and endanger the instruments in this circuit. It is chiefly for obviating this danger that one winding is short circuited, for if there is a sudden change in the magnetic field a current will be induced in the short-circuited winding which will in turn oppose the change in the strength of field. The short-circuited winding thus acts as a damper to choke out any sudden variations in magnetic field, with the accompanying high-induced voltage.

When the direct current is passed through the winding the magnetic field which is induced would reach very quickly its maximum value were it not dampened by the short-circuited winding; but on account of this winding the increase in the magnetic field is slow and a considerable length of time is required for the field to reach its maximum value. While the field is thus building up, an e. m. f. is generated in the transformer windings, which e. m. f. is in such a direction that it is added to the e. m. f. due to the resistance of the winding, and the voltmeter reading is higher than it should be on account of the resistance of the winding alone, and the true resistance drop will be obtained only after the field has become stationary.

Fig. 1 shows three curves giving the relation between the apparent resistance of the windings and the time from the instant that the current was sent through the winding. One curve shows the high-tension winding all in series, another the low-tension winding all in series, while a third shows the low-tension winding in multiple. It will be noted that approximately 30 minutes are required before the resistance, with all low-tension coils in multiple, reaches a stationary and true value. With the high-tension coils all in series, the resistance reaches a stationary value in approximately three minutes.

This difference in time depends upon the difference in magnetizing force. With the high-tension coils all in series there are 10 times as many turns as with the low-tension coils all in multiple, and since the same current is used in each case, the ampere-turns are 10 times as great in the first case as in the second, and the iron is more quickly brought to a stationary value.

If the winding is not short circuited it is found that the resistance becomes stationary almost immediately; but in addition to endangering the instruments there is often great difficulty in reading the voltmeter, on account of the rapid variations in voltage due to small though sudden changes in magnetic field. It is, however, possible to open the short-circuited winding for a short time until the magnetic field becomes constant, then to short circuit it and so choke out the rapid oscillations.

From the above it is evident that in measuring the resistance of the transformer care should be taken to ascertain that a constant resistance has been reached.

When the direct-current circuit is opened the field would fall almost instantly to a minimum value were it not checked by the short-circuiting winding, but the current induced in this winding by the dying field prolongs the life of the field so that several minutes are required before it disappears entirely. It was while the field was dying out that the short-circuited connection was opened and the arc drawn.

The iron losses of the transformers were measured by means of a wattmeter in the usual manner. This method of measuring, however, gives the total iron loss and does not separate the hysteresis from the eddy current loss. On account of the large size of these transformers it was desired to separate the iron losses in order to determine whether the ratio which is found to exist between hysteresis and eddy current loss in small test samples is maintained in a large transformer.

In order to make this separation the hysteresis loss was determined by a method devised by Mr. C. F. Scott for measuring the permeability and hysteresis loss on the field ring of one of the 5000-hp Niagara generators. This was, however, the first time the method had been applied to the measurement of the hysteresis loss of transformers.

The connections and instruments used for making the measurements are shown in Fig. 2. In the 11,000-volt winding is shown a direct-current ammeter and a water rheostat, the latter being so arranged that very close adjustments of resistance can be made over a wide range. Across the 22,000-volt terminals is a direct-current voltmeter.

If a direct current is sent through the low-tension winding, a magnetic field is induced in the iron. If the current is gradually increased or decreased, the magnetic field will also be increased or decreased. This changing field induces an e. m. f. in the transformer winding which may be measured by the voltmeter across the high-tension winding. If the rate of change in the magnetic field is uniform, there will be a constant e. m. f. generated in the winding, and the voltmeter needle will remain stationary.

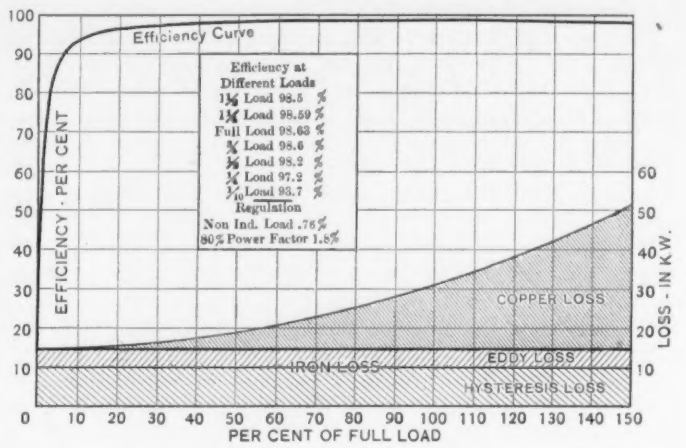


FIG. 3.—EFFICIENCY CURVE.

It was found that a rate of change of approximately 6 C. G. S. lines per square centimeter per second would give a reading of 0.1 volt on the voltmeter. By watching closely the voltmeter needle the resistance could be so changed as to give a constant reading of 0.1 volt. Starting with the iron demagnetized, at the end of one second the induction would be 6 lines per square centimeter, at the end of two seconds 12 lines, at the end of three seconds 18 lines, etc.; so that the time from the start gave a measure of the induction in the iron. The method used in taking the curves was as follows:

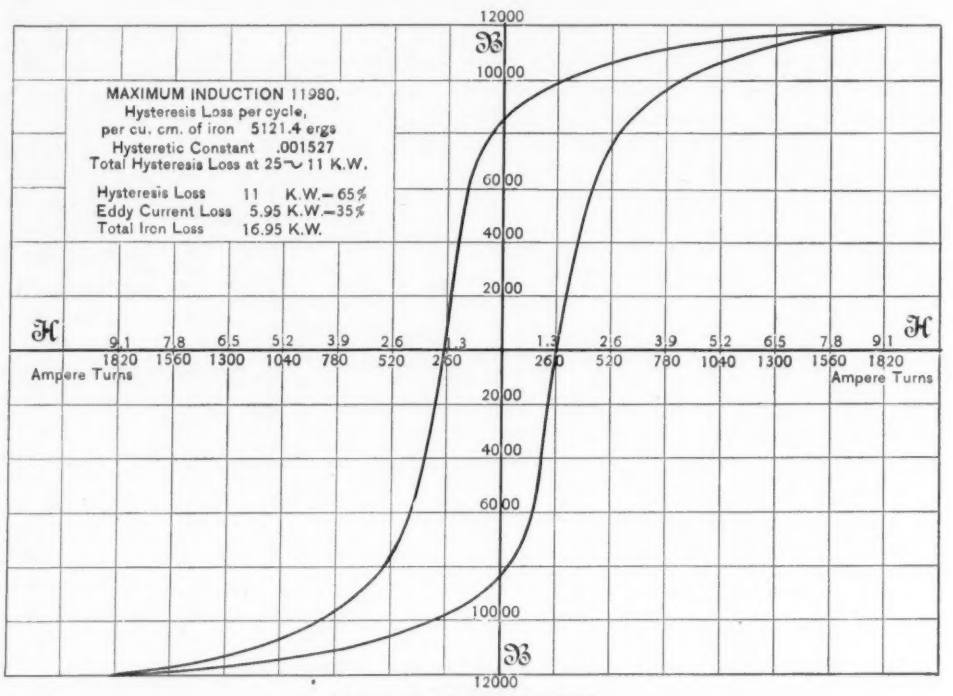
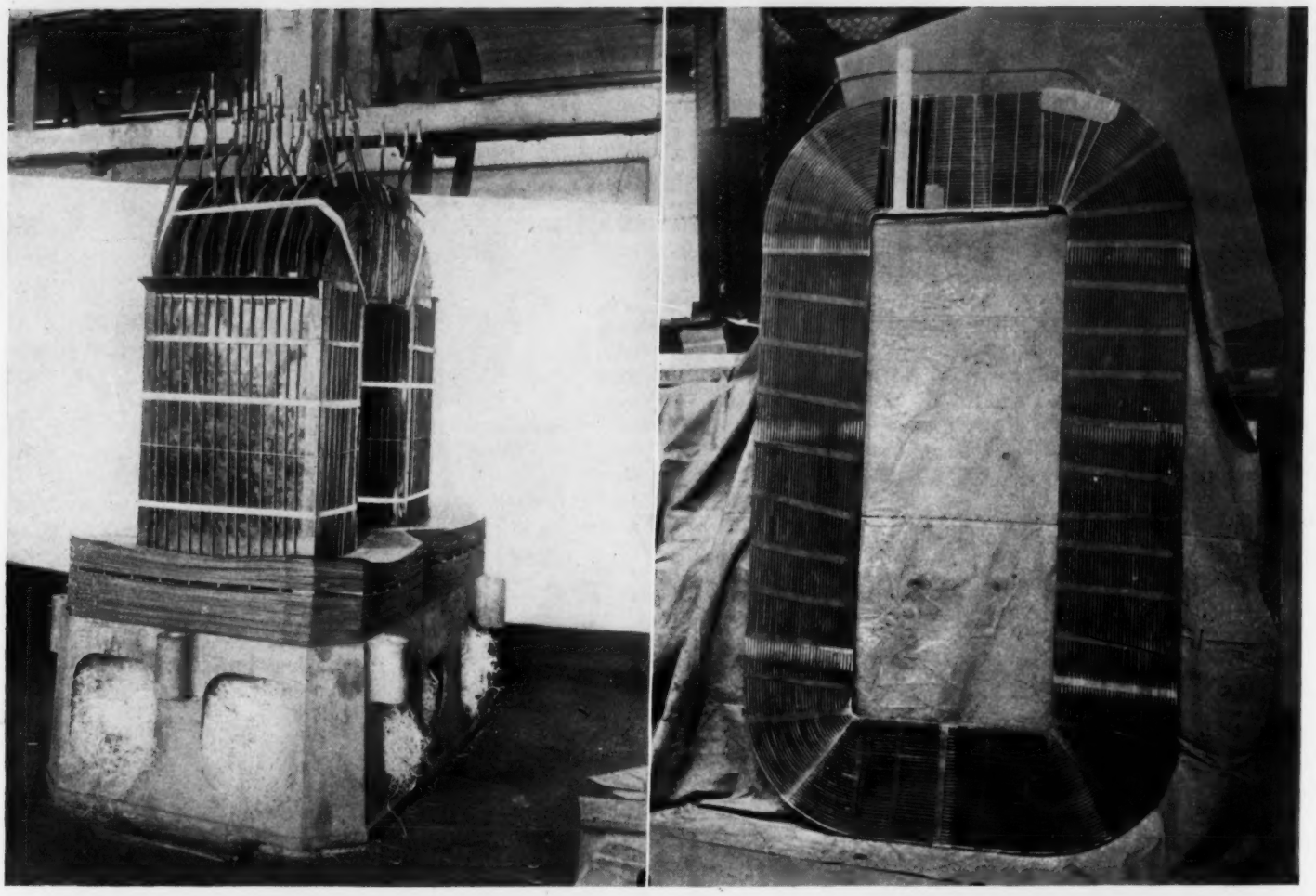
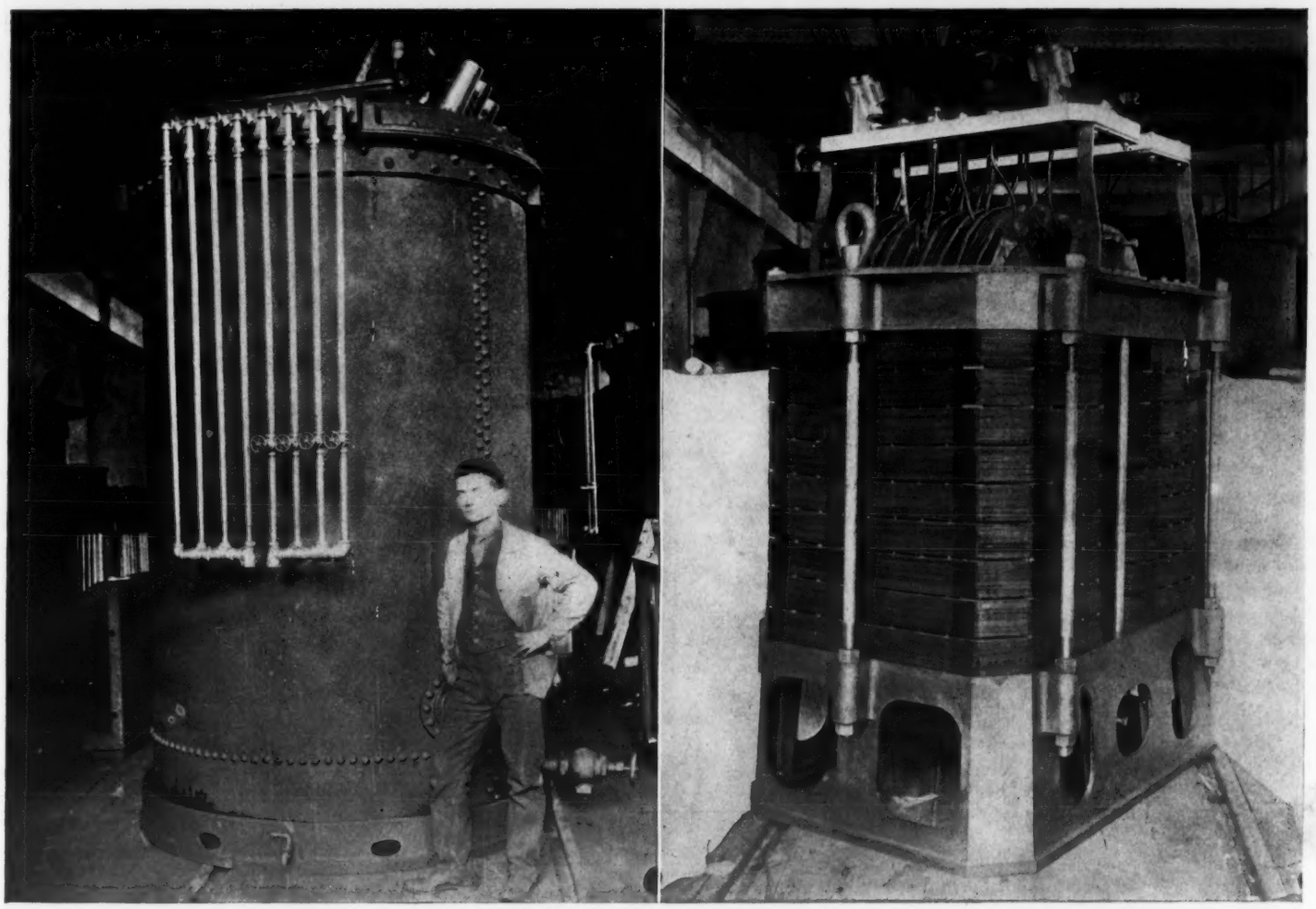

MAXIMUM INDUCTION 11980.
Hysteresis Loss per cycle, per cu. cm. of iron 5121.4 ergs
Hysteretic Constant .001527
Total Hysteresis Loss at 25~ 11 K.W.
Hysteresis Loss 11 K.W.—65%
Eddy Current Loss 5.95 K.W.—35%
Total Iron Loss 16.95 K.W.
Ampere Turns
Ampere Turns

FIG. 4.—HYSTERESIS CURVE.

Starting with zero current the resistance was cut out at such a rate as to give a steady deflection on the voltmeter. When the maximum desired induction was reached the voltmeter was reversed and the current gradually decreased to zero, then the current was reversed and gradually increased to a negative maximum, then the voltmeter again reversed and the current decreasd to zero, thus completing the cycle. Readings were taken of current every five seconds, so that with a deflection of 0.1 volt the points came very close to-





FIGS 5, 6, 7 AND 8.—VIEWS SHOWING TRANSFORMERS IN DIFFERENT STAGES OF ASSEMBLING.

gether on the curve. The instruments were so arranged that a complete cycle could be carried through without a moment's stop at any point.

In taking the readings four men are desirable—one to vary the resistance and so hold the voltmeter constant, one for calling off the time intervals for readings, one for reading the ammeter and one for taking down the readings.

In order to get the iron "into step," the transformer was run through the complete cycle several times before any readings were taken. With this method it was, of course, necessary to locate the horizontal axis after the curve was plotted, but this could be done without difficulty as the loops closed on themselves accurately and were found to be almost perfectly symmetrical about the two axes.

The hysteresis loss per cycle is represented by the area of the loop, and was found to be 3958 ergs per cycle at 10,260 gausses, and 5121 ergs per cycle at 11,980 gausses.

Using the equation $L = K \mathfrak{B}^{1.6}$ where L = hysteresis loss in ergs per cycle and $\mathfrak{B}$ = maximum induction, it is found that $K = 0.00152$ for a maximum induction of 10,260 gausses, and $K = 0.001527$ for a maximum induction of 11,980 gausses.

Considering the fact that the magnetic circuit is rather wide and that the induction cannot be equally distributed over this section, the

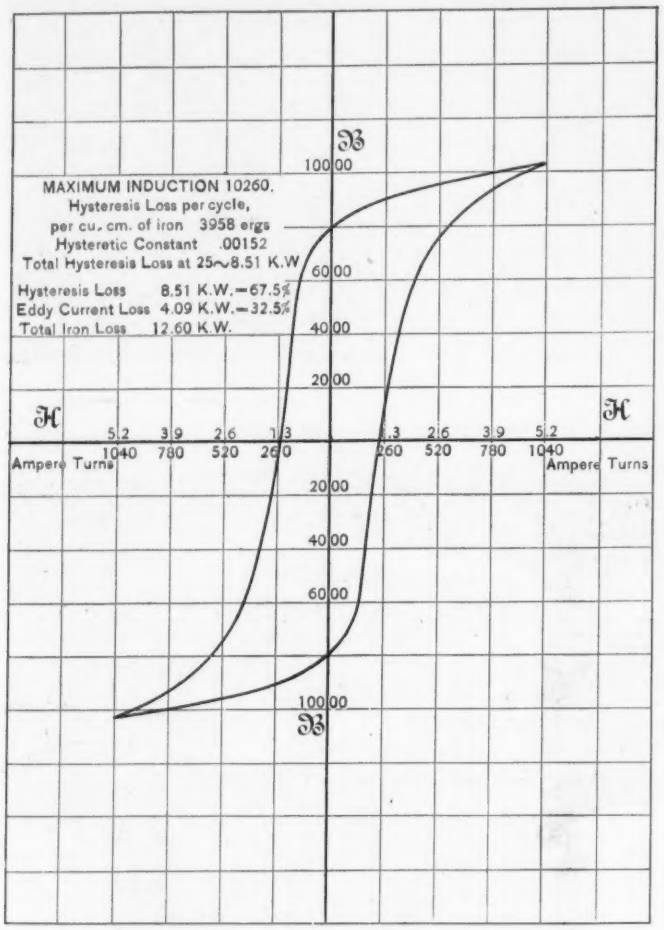


FIG. 9.—HYSTERESIS CURVE.

hysteresis constant is quite small and lower than is often obtained on small samples of transformer iron.

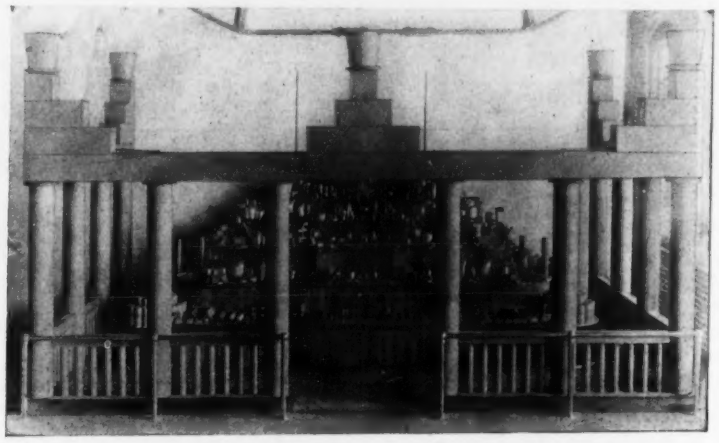
The eddy current loss is found by deducting the hysteresis loss from the total iron loss. At an induction of 10,260 gausses the eddy current loss is 4.09 kilowatt per transformer, and 5.95 kilowatt at 11,980 gausses. Assuming that this loss varies as the square of the induction, and that it is 4.09 kilowatts at 10,260, it should be $4.09 \times \frac{(11{,}980)^2}{(10{,}260)^2} = 5.56$ kilowatts at 11,980. The measured value 5.9 is approximately 7.5 per cent higher, but this difference may be accounted for by the unequal distribution of the flux in different parts of the circuit.

The simplicity of this method of measuring the hysteresis loss of transformers is apparent. Its chief interest, however, lies in the fact that it is the only practical method yet devised for measuring this loss on a completed transformer.

National Carbon Exhibit at the Pan-American.

The National Carbon Company, of Cleveland, Ohio, has a notable exhibit at the Pan-American Exposition. It consists of a large assortment of its products made wholly or in part from carbon, and is designed to show in a compact arrangement the important position in the industries which the manufacture of carbon has now attained.

The plan of the exhibit is a design in Pompeian villa effect, and the material out of which it is formed is entirely of carbon taken from different shapes and forms in actual use in different industries, and not made up especially for this exhibit. The pillars are solid carbon columns 9 inches in diameter by 80 inches long, capped with 10 x 10-inch solid slabs. Both of these shapes are used in electrolytic and smelting work. The 3-inch electrodes are the well-known forms used in manufacturing aluminum. The exhibit of the smaller forms, such as batteries, specialties and carbon pencils for lighting, is arranged in a series of platforms or steps in a pyramidal form against the wall. It contains over 1000 different shapes. The shapes and sizes range all the way from small globules less than 1-32 of an inch in diameter to the large electrodes used in smelting and which weigh up to 600 pounds each.



CARBON EXHIBIT IN ELECTRICITY BUILDING.

Especial attention is called to the different kinds of complete batteries shown, including all the best known and most efficient forms of the wet battery and gravity cell types, and also the most used sizes of the "Columbia" dry cell. The specialties include back plates, diaphragms, granular and globular carbons used in telephone work, and of which a great many forms are shown.

Scattered throughout the exhibit are a large variety of motor and generator brushes. In electric light carbons only a few of the different lengths and sizes are shown.

Exhibit at the Telephone Convention.

The Lambert Schmidt Telephone Manufacturing Company had, as noted in these pages already, a very elaborate exhibit for the independent telephone convention at the Iroquois Hotel on June 11, 12 and 13. Their exhibit consisted of two portable army field switchboards, one 40 drop regular type army board, and a 100 drop combined series and bridging switchboards. They showed also army telephone field sets, their regular exchange telephone, consisting of generator call and common battery wall telephone, portable desk telephones, microtelephones, their automatic reset inter-communicating wall and desk sets, many combinations of private line instruments and parts in detail of their cordless adjustable arms, transmitters, receivers, etc. They made a particular feature of showing the inside of both switchboard and telephones, as illustrating the fine workmanship throughout. The two army portable field switchboards attracted considerable attention, being a novelty in this line. These boards are of six and ten drops respectively. No cords or jacks are used. In regard to the ten drop outfit, it may be stated that all the parts are inclosed in a heavy, compact oak case with a door at the front and back. Inside at the front is a hard-rubber panel on which are mounted in the first row 10 drops, second row

10 red ringing cams, third, fourth and fifth rows being composed each of 10 black cross connecting cams, and sixth row three white listening cams, and below a night bell cam. There is one ringing cam for each line and one listening cam for each row of black cams. The cross connections on the first call would be made on the first row of black cams, using the first listening cam to the left; the second cross connection would be made on the second row of black

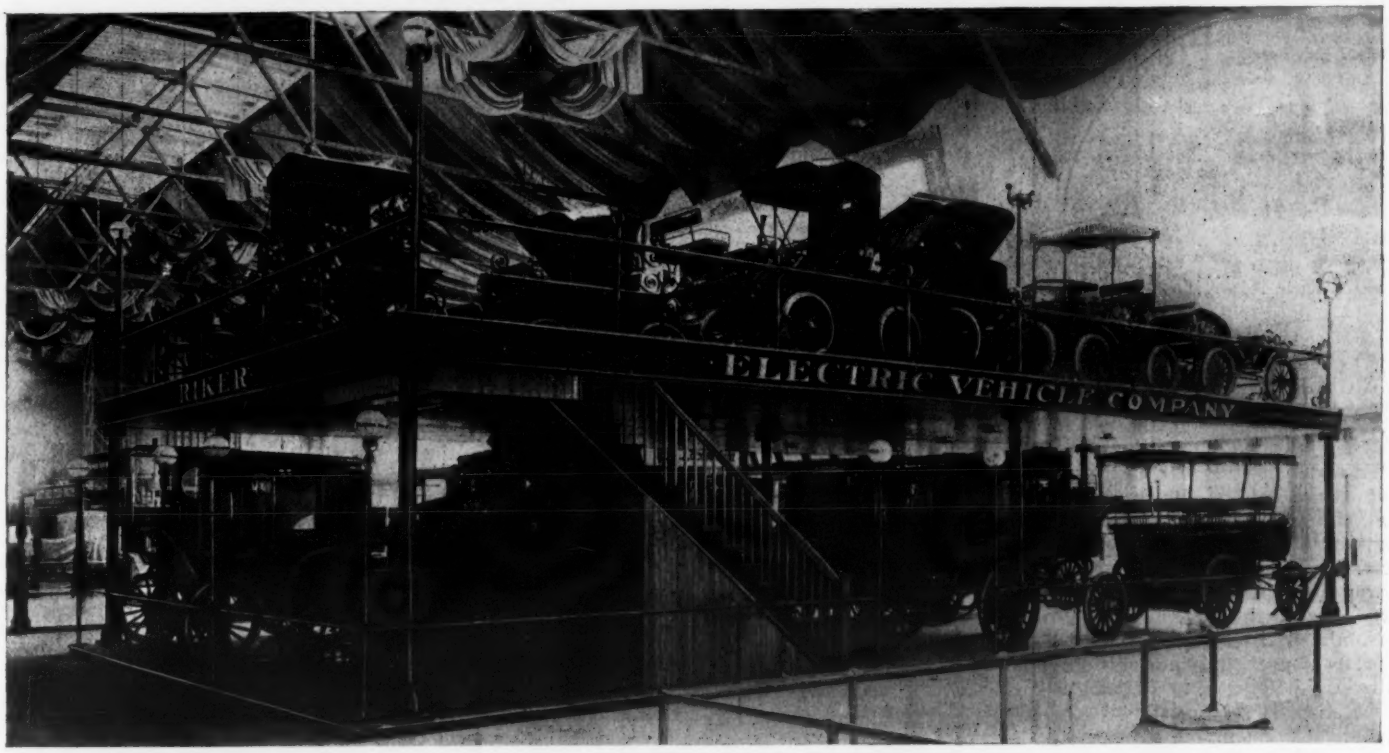
TELEPHONE EXHIBIT.

cams, using the second listening cam, etc. The ringing on any line can be made by the individual red ringing cams. The board is provided with their army type hand microtelephone and bridging generator and with binding posts at the top for line connections. The board weighs 63 pounds, is compact and can be shifted at a moment's notice. A strap at the top is used for carrying.

They exhibited a trick telephone in the shape of a common battery wall instrument. A delegate on being requested to try the telephone would lift the receiver from the hook, when the lid of the ringer box would fly up, showing a bunch of cigars and a notice, "Take one." It is needless to say that the invitation was seldom refused. The company was ably represented by Mr. Lambert Schmidt, president; Mr. Schwartz and Mr. W. W. Bostwick, Jr. They received many congratulations on the high quality of their apparatus.

Exhibit of the Electric Vehicle Company.

One of the most striking exhibits in Machinery and Transportation Building at the Pan-American Exposition is that of the Electric Vehicle and Riker Motor companies. It stands in the center of the vast hall, and is in full view from the big doorway of Electricity Building, across one of the sunken gardens, so that it has the unusual advantage of being conspicuous in two buildings and two groups at once. Another novelty is that the exhibit is double-decked, several of the vehicles being carried on the upper deck. In all, there are over thirty automobiles of the well-known "Columbia" and "Riker" types in the company's enclosure in the transportation building and several others in practical demonstration about the Exposition grounds. Of the Columbia vehicles on exhibition there are the following: One phaeton, one tricycle carrier, one gasoline runabout, one wagonette, one six-passenger omnibus, one runabout with wooden wheels, one runabout with buggy top and wire wheels, one Victoria with wire wheels, one Victoria with canopy top and wooden wheels, one extension front brougham, one surrey, one cabriolet, one rear-boot Victoria, one delivery wagon. The Riker list includes one piano-box runabout, one Victoria, one phaeton, one spider phaeton, one mail phaeton, one Victoria De Luxe, one delivery wagon, one two-ton truck, one Wilkesbarre bus, one theatre bus, one public hansom, one railway cab, one straight front brougham, one demi-coach, one brake, one gasoline voiturette. A Columbia delivery wagon is under contract to carry the mail between the Buffalo Post Office and the Pan-American grounds, and several vehicles of a smaller type are very much in evidence, as they go around to distribute mail about the Exposition grounds. The pleasure vehicles to be exhibited include runabouts, phaetons, Victorias, surreys and cabriolets. Vehicles of this type are equipped with new long-distance batteries, which have a running capacity of forty miles on one charge. The various types have already been described to the readers of this journal in detail, but seen thus collectively they present many features for new study and comparison, and are a great center of attraction for visitors to the Machinery Hall. Mr. J. M. Hill, who is in active and efficient charge of the exhibit, has encountered an endless demand for information, and has been able several times to assist the management with the loan of vehicles for special necessities and functions.



ELECTRIC VEHICLES AT PAN-AMERICAN EXPOSITION.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Call money closed at 3 to 4 per cent. Time money was easier and closed at about the same figures. The rates for mercantile paper are 3¾ a 4¼ for 60 to 90 days' indorsed bills receivable, 4 a 4½ for the highest grade of 4 to 6 months, single names, and 5 a 5½ for others. In the stock market there was limited speculative activity, but prices were strong and advances were scored in the railroad lists. Among the industrial stocks, United States Steel securities were unfavorably affected by the reports that the Pennsylvania Railroad has acquired control of the Pennsylvania Steel Company, but it subsequently recovered. In the traction list, Manhattan showed strength on favorable reports of earnings which will result from the equipment of the line with electric power. This stock closed at a net advance of 5⅝ points. Brooklyn Rapid Transit closed with a net gain of 1½ points, the number of shares sold being 65,370. Metropolitan Street Railway made a net gain of 3¾ points on transactions of 30,600 shares. There was little trading in General Electric, which, however, closed with a net gain of 3¼ points, the closing quotation being 248, ex-dividend. The sales were only 1825 shares. Western Union showed greater strength, and closed with a net gain of 2 points, on sales of 48,300 shares. There were no special features in the outside market; trading was light, with the majority of price changes showing a gain. Copper stocks keep a steady tone; Otis Elevator sold at 32, with no activity. The automobile stocks show declines, with the exception of New York Electric Vehicle Transportation, and New England Electric Vehicle, which remain at about the same price as quoted last week. Following are the closing quotations:

NEW YORK.

	June 8.	June 15.		June 8.	June 15.
General Electric	246¾	248	Electric Vehicle	11	10
Brooklyn Rapid Transit	80	81½	Electric Vehicle, pfd	18	16
Metropolitan Street Ry	171¾	175½	General Carriage	2	1⅞
American Tel. & Cable	100	99½	Illinois Elec. Veh. Tran.	⅞	⅞
Western Union Tel	94	96	Hudson River Tel	120	120
American Dist. Tel	—	—	N. E. Elec. Veh. Tran	3⅛	3⅛
Commercial Cable	—	—	N. Y. Elec. Veh. Tran	11½	11¾
Electric Boat	22	22	Tel. & Tel. Co. of Am	5	5
Electric Boat, pfd	51	50	N. Y. & N. J. Tel	170	170
Electric Lead Reduc'n	3½	3½			

BOSTON.

	June 8.	June 15.		June 8.	June 15.
New England Telephone	—	143	Erie Telephone	57½	54
Mexican Telephone	2½	—	General Electric, pfd	—	—
Westinghouse Electric	70	69	Am. Tel. & Tel	173¾	152
Westinghouse Elec., pfd.	75	76	Boston Electric Light	240*	—

PHILADELPHIA.

	June 8.	June 15.		June 8.	June 15.
Electric Storage Battery	58	53	Philadelphia Electric	5½	5½
Elec. Storage Batt'y, pfd.	60	52	Pa. Electric Vehicle	1	1
Elec. Co. of America	8¾	8¾	Pa. Elec. Veh., pfd	1	1
General Electric Auto	—	—	Am. Railways	45	43½

CHICAGO.

	June 8.	June 15.		June 8.	June 15.
Chicago Edison	175	177	Chicago Telep. Co	270	275
Chicago City Ry	250	—	Union Traction	18¾	19¼
National Carbon	16	16	Union Traction, pfd	49	58
National Carbon, pfd	84½	84	Northwest Elev. com	48	49

*Asked.

PURCHASE OF TOLEDO TROLLEYS.—Announcement is made of the purchase by the Everett-Moore syndicate of Cleveland, of all the street railway lines of Toledo, and other negotiations in progress, when completed, will give the syndicate control of all electric railways between Detroit and Cleveland. Every electric railway in Northern Ohio and Southern Michigan will also be merged, with the exception of Pomeroy interests and the Little Consolidated Street Railway of Cleveland. The suburban traction property at present being considered for purchase by the syndicate is the Rapid Railway, of Detroit, and the Toledo, Fremont and Norwalk Railway. At a meeting of the stockholders of the Sandusky & Interurban Company, it was decided to make a transfer of the property to the Lake Shore Electric Railway, an Everett-Moore property. E. W. Moore and Henry A. Everett have been in New York in conference with bankers. The purchase price of the Toledo lines is said to be $9,000,000. The scheme of the promoters is to control urban and interurban traction lines between Cleveland and Detroit along the lake shore. The Toledo purchase embraces all the electric lines in that city known as the Toledo Traction Company, consisting of 99 miles of track.

NEW YORK ELECTRIC VEHICLE.—Last week a report was circulated in Wall Street, as a dispatch from Newark, N. J., that Vice-Chancellor Stevens had issued an injunction forbidding the collection of the assessment upon the stockholders of New York Electric Vehicle Transportation, which was ordered on June 5. A suit is pending in chancery calling upon the company to show the condition of its affairs, but the officials of the company say that no such injunction was issued when the bill was filed, nor at any other time; in fact, the state of the proceeding is simply that a stockholder's bill has been filed, on which a hearing will be had this week. President Sanderson, of the Transportation Company, says that when the hearing is had his attorneys will fully acquaint the public with the assets of the company, what was paid for them, how they were acquired, what they are worth at the present time, how the new assessment came to be made, and what is intended to be done with the money collected. He says he will show that the company is in a splendid condition. It is stated that the assessment has already been largely paid in.

BIRMINGHAM, ALA., BONDS.—The Birmingham Railway, Light & Power Company, which consolidated the street car, gas and electric light properties of Birmingham, has called a meeting of the stockholders of the three properties to be held in Birmingham July 18. The purpose of the meeting is to arrange for an issue of $6,000,000 of bonds and agree on a trustee, and also to ratify the appointment of the Old Colony Trust Company, of Boston, Mass., as transfer agent. Robert Jemison, now vice-president of the Birmingham Railway, Light & Power Company, will be president of the consolidated company. A board of directors has been agreed upon, including Gordon Abbott, Boston; J. K. Newman, New Orleans; H. M. Atkinson, Atlanta, and T. T. Hillman, William A. Walker, Nat Baxter, Jr., G. B. McCormack, M. V. Joseph, Robert Jemison and A. M. Shook, of Birmingham.

CHICAGO EDISON.—The Chicago Edison Company has increased its capital stock from $6,000,000 to $10,000,000. The right to subscribe for 15 per cent of the increase will be given to the stockholders at par on Aug. 1. The financial statement of the company for the year ending March 31, 1901, is summarized as follows: Gross earnings, $2,517,000; expenses, including dividends, interest on bonds and debentures, $2,371,000; balance, $146,000. The old directors were re-elected. President Insull is quoted as saying: "While our stock has been increased $4,000,000, we shall issue only $900,000 to stockholders at par about Aug. 1. The other $3,100,000 will remain in the treasury for use as the extension of business demands. This authorization gives the board of directors the right to issue new stock from the treasury at its option, but it will be put out only on needed improvements."

NIAGARA POWER.—At a meeting of the board of directors of the Niagara Falls Power Company the officers of last year were re-elected and Daniel O'Day and Victor Morawetz were added to the board. The board took action upon the proposition to develop power on the Canadian side of the Niagara River under the charter of the Canadian Niagara Power Company, which it controls. Work has been commenced in the Queen Victoria Niagara Falls Park, and will be pushed vigorously to a first installation of not less than 25,000 horse-power. It is proposed that half of this shall be transmitted to Toronto to be used in that city, the Buffalo transmission having proved satisfactory and remunerative.

DIVIDENDS.—The United Traction & Electric Company, of Jersey City, has declared the regular quarterly dividend of 1 per cent on the capital stock, payable July 1. The Manchester Traction, Light & Power Company, controlling the electric light and street railway interests of Manchester, N. H., has declared its first semi-annual dividend of 3 per cent, payable July 15. United Gas Improvement Company, of Philadelphia, has declared a quarterly dividend of 2 per cent ($1 per share), payable July 15.

WASHINGTON TRACTION & ELECTRIC.—The reorganization committee of the Washington Traction & Electric Company held a meeting a few days ago. It was substantially agreed that the bondholders would receive in lieu of their present collateral trust bonds, new mortgage 4 per cent bonds to the par value of 55 per cent and preferred 5 per cent stock to the par value of 55 per cent, thus giving the bondholders in fixed charge and preferential securities 110 per cent of their present holdings.

AMERICAN TELEPHONE & TELEGRAPH.—It is stated that American Telephone & Telegraph will soon be listed on the New York Stock Exchange. New York holders of the stock think this will add 25 per cent to the market value of the stock, as New York banks will then accept it more favorably as collateral.

WESTERN UNION STATEMENT.—The estimated returns of Western Union Telegraph Company for June 30 quarter compare as follows:

	1901.	1900.
Net revenue	$1,750,000	$1,600,925
Bond interest	239,040	223,945
Balance	$1,510,960	$1,376,980
Dividend	1,217,001	1,217,000
Surplus	$293,959	$159,980

The report for the year ended June 30, partly estimated, will show the following results:

	1901.	1900.
Net revenue	$6,672,810	$6,165,362
Bond interest	956,120	906,102
Balance	$5,716,690	$5,259,260
Dividends	4,868,003	4,867,983
Surplus	$848,687	$391,277
Accrued surplus	9,306,891	8,458,204

The directors of the company have declared the usual quarterly dividend of 1¼ per cent, payable July 15.

INSPECTING OHIO ROADS.—C. D. Jameson, an electrical engineer and expert representing large New York and London banking houses, visited Cleveland last week and went over several of the properties of the Everett-Moore syndicate with a view to making a thorough examination of the character of the lines. He stated that the banking houses he represents propose devoting much attention to the investment of capital in street railway enterprises, and that Cleveland was selected as the most advantageous point for such investigation. In company with several officials of the various roads, he was shown over the Northern Ohio Traction Company, the Lorain & Cleveland Railway, the Cleveland, Painesville & Eastern Railway and the Cleveland & Eastern Railway. The trips to Akron and Chardon demonstrated the ability of electric cars to surmount heavy grades while the ride to Lorain showed something of the speed of a first-class electric line. On the return from Lorain the run from the power house to the city limits, eight miles, was made in 11 minutes including two stops. As a result of his inspection he will make a favorable report, and it is expected that in the near future, a financial expert will visit the city and make a thorough examination into the finances of the various roads.

MEXICAN TELEPHONE.—The Mexican Telephone Company reports for April show these results:

	1901.	1900.	Changes.
Gross earnings	$17,339	$15,078	Inc. $2,261
Operating expenses	8,197	7,687	Inc. 510
Net earnings	$9,142	$7,391	Inc. $1,751
From March 1 to April 30:			
Gross earnings	$34,543	$29,710	Inc. $4,833
Operating expenses	19,324	17,419	Inc. 1,905
Net earnings	$15,219	$12,291	Inc. $2,928

NEW ENGLAND TRANSPORTATION.—It was reported this week that the New York Transportation Company had purchased the New England Electric Vehicle Transportation Company. This is not true, but probably arises from the fact that the New York Company had purchased, or will within a few days, the Newport branch of the New England Company. Negotiations for a sale of the assets of the New England Company have been opened with a number of interests, but other than a sale of the Newport department nothing has been consummated.

BOSTON CONSOLIDATION.—Stockholders of the Edison Electric Illuminating Company at a special meeting called for June 24 to act on the merger of the Boston Electric Light Company will also vote on the question of increasing the board of directors from 9 to 12 members. Four Boston Electric Light Company directors will be added to the board should the increase be voted, as there is a vacancy in the present Edison board.

BROOKLYN RAPID TRANSIT.—The Brooklyn Rapid Transit Railroad reports gross earnings for April of $989,993, an increase of $5,409, as compared with the same month of last year, and net $331,711, an increase of $13,287. For the 10 months ending April 30, the gross earnings were $9,844,597, an increase of $284,849, as compared with the corresponding period of last year, and net $3,321,865, an increase of $439,365.

UNION TRACTION, PHILADELPHIA.—The Union Traction finance committee, which has just completed an examination of the underlying and other securities in the company's treasury, found the aggregate value of such securities to be $8,000,000. In addition, there is between $700,000 and $800,000 in the company's insurance fund.

Commercial Intelligence.

THE WEEK IN TRADE.—The general improvement in trade, noted in last issue, continued during the past week, both as to tone and volume. The prospects in the great staples—wheat, corn and cotton—are very satisfactory, and these conditions are reflected in all other lines of retail trade. One of the most satisfactory features of all is that, after quite a period of dullness, pig iron has been taken more freely at leading markets, and bars and plates have sold better, the latter even noting an advance. The production of pig iron is proceeding at an unprecedented rate, but consumption appears to wait promptly upon output. Railroad earnings continue in undiminished volume, and the only unfavorable feature in the general industrial situation is the failure to settle the machinists' strike. At the close of the week the strikers gave up the fight in some quarters, but there is a wide belief that the contest will be long drawn out. Specially good trade reports coming from the Northwest and Southwest, are induced by liberal rains affecting the wheat crop outlook. There is an active demand for building material generally, particularly in the lumber line. In the iron and steel industries, wire and wire goods are in heavy demand, and deliveries are behind hand. Machinery manufacturers are moving cautiously as to future contracts on account of the uncertainties of the machinists' strike. For the month of May 94 roads, operating over 103,000 miles, report earnings that aggregate $59,986,000, 9.2 per cent in excess of the figures for May, 1900. Southwestern roads show the heaviest ratio of increase, 26 per cent, followed by the central-western roads with 13.3 per cent, while next in order are the coal roads on 10.2 per cent. The trunk lines report an increase of 6.4 per cent, the Pacific roads 5.6 per cent and the grangers 2.8 per cent. The coal roads show a decrease of 11.9 per cent and the Mexican roads one of 3 per cent. The business failures for the week as reported by *Bradstreet's*, aggregate 188, as against 163 the week previous, and 180 the same week last year; 150 in the same week in 1899, 207 in 1898 and 226 in 1897. The copper market remains firm, with unchanged prices. Very little new business has been done, and there was practically no export demand. Prices are: Lake, for home consumption, 17 cents; electrolytic and casting copper, 16⅝ cents.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week ended June 12: Antwerp—16 packages electrical material, $894. Argentine Republic—98 cases electrical material, $2,043; 1 case electrical machinery, $345. Bilboa—2 cases electrical material, $100. Berlin—40 cases electrical machinery, $380. British Guiana—18 packages electrical material, $410. Bremen—4 packages electrical material, $120. Brazil—35 cases electrical machinery, $982; 14 cases motors and parts, $180. Barcelona—1 package electrical machinery, $57; 11 packages electrical material, $369. British Australia—55 cases electric machinery, $12,512; 18 cases electrical material, $940; 8 motors, $250; 6 motor vehicles, $5,000. British East Indies—1633 packages electrical material, $253,914. British West Indies—3 packages electrical material, $138. Central America—3 packages electrical material, $62. Copenhagen—2 packages electrical material, $30. Cuba—174 cases electrical material, $5,985. Dundee—1 package electrical material, $30. Dutch West Indies—4 packages electrical material, $41. Ecuador—115 packages electrical material, $903. Genoa—14 packages electrical material, $926. Glasgow—4 packages electrical machinery, $575. Gijon—9 cases electrical material, $1,622. Hamburg—31 packages electrical material, $1,277. Havre—10 packages electrical machinery, $14,052; 127 packages electrical material, $3,110. Japan—18 packages electrical material, $650. London—580 packages electrical material, $34,551. Liverpool—73 packages electrical machinery, $6,435; 854 packages electrical material, $2,922. Libau—2 packages electrical material, $521. Lisbon—1 package electrical material, $30. Marseilles—25 packages electrical material, $300. Mexico—93 packages electrical material, $2,175. Moscow—15 packages electrical machinery, $1,791. Milan—8 cases electrical material, $1,164. Palermo—1 package electrical material, $9. Peru—4 cases electrical material, $210. Riga—6 packages electrical material, $600. St. Petersburg—1 case electrical material, $187; 1 case electrical machinery, $70. Southampton—21 packages electrical material, $1,288. Stockholm—1 case electrical material, $17. St. Helena—3 packages electrical material, $190. Uruguay—1 package motor carriage, $290. U. S. Colombia—4 packages electrical material, $113. Venezuela—91 packages electrical material, $1,696.

NEW STURTEVANT FACTORY.—After a most careful consideration of sites, the B. F. Sturtevant Company has recently completed the purchase at Hyde Park, Mass., of a tract of land containing some 15 or more acres, and is preparing plans for the erection thereon of a large up-to-date plant for the manufacture of blowers, engines, motors, forges, heating apparatus, etc. This purchase, although hastened by the recent fire which damaged the works at Jamaica Plain, Mass., which will be eventually abandoned, is

the natural outcome of the rapid growth of this concern during the past few years, and of the congested condition of the present plant in which increased facilities could not be advantageously provided. The new site is on the same railroad line, the N. Y., N. H. & H. R. R., only five miles from the old plant and less than ten miles from Boston. It is admirably located; 1300 ft. along one side abut upon the railroad with all desired switching facilities, an ample stream of water marks the boundary on another side, a noted spring of remarkable purity is within the area, the high ground which is practically on a level with the tracks will accommodate buildings having a floor area of 750,000 square feet, ample for all needs of the immediate future. The lower land furnishes abundant area for dumping. The new plant will be arranged to reduce to a minimum the labor cost of handling material, and will provide for its direct progress through the shop from foundry to shipping room. It will be equipped throughout with new modern tools and labor-saving devices.

AUSTRIAN DISCRIMINATION.—Consul Schumann, reporting from Mainz to the State Department on the methods employed by Austria to protect home industries, quotes a trade journal which declares that the Government threatened to withdraw the subsidy granted to a hat factory at Temesvar because the latter had ordered an electric lighting plant from a German firm, and was only prevented from carrying out its threat by being convinced that there was no firm in Austria which could have carried out the contract as required. A match factory at Raab was reproved by the Government for purchasing foreign materials. The electric tramway companies of Fiume and Temesvar were fined for purchasing their motors from a German firm. The electric mining road of Derna only received permission from the Government to purchase locomotives, dynamos, etc., from a German firm after the managers had proved conclusively that for their special purposes they could use only the machines of this firm. Furthermore, it is said the Austrian Government keeps a register of all Austrian firms which purchase foreign goods or raw material, and to such firms the Government never grants the least favors, nor do they ever receive Government contracts.

WANT NO EDISON FACTORY.—Mr. Thomas A. Edison's purchase of the Hayden mill in Glen Ridge, N. J., for use in manufacturing his new storage battery, has filled the Glen Ridge Park Association with alarm. The association's fears were embodied in a communication sent to the Borough Council last week, and the latter body, becoming frightened, voted in favor of issuing $35,000 worth of bonds to be used in purchasing the property for park purposes. A special election will be called at the earliest possible date to obtain the approval of the voters. "About two years ago," said the communication to the Council, "the citizens of this place decided to form an association known as the Glen Ridge Park Association for the purpose of acquiring real estate. This was for the purpose of preserving this section of the glen. The reasons for the application to the Council are especially pressing just now. Thomas A. Edison has acquired the property known as the Hayden mill, and the advent of a large number of workingmen may cause the erection of a business structure of an objectionable character in the immediate vicinity of the works and park, and the beautiful rural appearance of the neighborhood may be seriously menaced thereby."

ANOTHER LONG ISLAND TUNNEL.—The Long Island Extension Railroad Company has been incorporated to build and operate by electricity underground tunnels about four miles long over the route, from near the Long Island Railroad property in Queens Borough, running thence to and under East River, to and under Manhattan Borough, to a point south of Fiftieth Street and Broadway, which points are to be the terminals. The capital is $1,000,000. The directors are Dumont Clarke, William H. Baldwin, Jr., New York City; Thomas DeWitt Cuyler, of Heverford, Pa.; C. Stuart Patterson, Sutherland M. Prevost, Philadelphia; John P. Green, of Rosemont, Pa.; William A. Patton, Radnor, Pa.; Charles E. Pugh, of Overbrook, Pa.; Samuel Rea, of Bryn Mawr, Pa. The latter takes 780 of 1000 shares of stock subscribed for. Mr. Baldwin, who is president of the Long Island Railroad, states that the scheme means the electrical extension of the road right into New York City.

THE L. WOLFF MANUFACTURING COMPANY, manufacturers of plumbers' supplies, recently contracted with the Northern Electrical Manufacturing Company, of Madison, Wis., through its Chicago office, for a complete equipment of generators and motors to be installed in their immense works located at Carroll Avenue and Roby Street, Chicago. Constant additions to their plant, coupled with the necessity of introducing modern methods, were the principal reasons for making the change at this time. The installation will consist of two 200-kw, 250-volt generators, direct connected to Allis-Corliss engines, operated at a speed of 110 r. p. m. The motors will be slow speed, a number of them being entirely enclosed, and arranged, as far as possible, for individual driving of machines throughout the plant, ranging in sizes of from 7½ to 80 horse-power each.

GERMAN DEPRESSION.—Special cables from Berlin, of June 16, say: The week began with the crash of the Dresden Credit Anstalt and the Kummer Electric Company, which owes 9,000,000 marks to the Dresden Credit Anstalt alone. Rumors are in circulation to the effect that a number of other electric concerns and the banks supporting them in Dresden, Berlin and Dantzic are in serious difficulties. The week was notable for rumors. They found sustenance in the highly unfavorable reports which came in from every kind of business, especially concerning Westphalian industrials and iron and machine firms and mining concerns. It generally was pointed out that many German electric works were neither founded soundly nor financiered soundly, and in consequence of these conditions fears are expressed that other concerns would encounter financial difficulties.

PLANT FOR BROOKLYN TROLLEYS.—President Jacob L. Greatsinger, of B. R. T., is quoted as follows: "The chief difficulty has been that we have not had enough power to move our rolling stock as it should be moved. For example, the recent fire in the Kent Avenue power house was due to the fact that our machinery was unable to stand the strain of traffic in the rush hours of the early morning. The dynamo had too much work to do and gave out. We have been studying the problem and are in a fair way to arrive at the solution. The system is also in need of more cars. We are now placing 150 new cars into service, 100 on the surface lines and 50 on the elevated roads." In the meantime, to help out, 24 of the old locomotives have been called in to carry part of the traffic.

RAILWAY CONTRACTS.—The Cleveland office of the Westinghouse Electric & Manufacturing Company has recently closed several good contracts, among them the following: Garrett-Cromwell Engineering Company, engineers for the plant of Crucible Steel Company, at Pittsburg, three 550-kw, 125 r. p. m., 250-volt direct-current engine type generators, to be direct connected to Allen-Porter engines; Cleveland City Railway Company, one 1500-kw, 75 r. p. m., 550-volt railway generator, to be direct connected to a 2250-hp cross-compound Allis-Corliss engine, and 11 quadruple equipments, No. 56, Westinghouse motors, to the Mahoning Valley Railway Company for use on the company's new extension to New Castle.

FRANKLIN ELECTRICAL MANUFACTURING COMPANY.—Note is made elsewhere in this issue of the death by accident of Mr. John Waring, president of this company. Mr. Jonathan Camp, the secretary and treasurer, in reply to inquiries, says: "While we can never hope to replace Mr. Waring as a friend and business associate, his death will in no way affect our enterprise, and the company will continue the manufacture in the regular way of its incandescent lamps. We have already made arrangements for doing the work formerly performed in the carbon house and laboratory, and are in a position to fill orders promptly." The fire at the factory was in reality of small extent, although so sadly fatal.

ELECTRIC PRINTING.—The Seattle *Intelligencer* celebrates with a special issue its new press equipment. The handsome new Hoe press is driven by a C. & C. Electric Company 50-hp, 6-pole, double-commutator, compound-wound, 250-volt motor directly geared to the main driving shaft of the press, the maximum motor speed being 400 r. p. m. The company's new system of series parallel control is used, affording the widest variations in speed. Current is taken through a fine marble switchboard from the mains of the Seattle Electric Company.

CONSOLIDATING FIXTURE INTERESTS.—A certificate of consolidation of the American Gas Fixture Company, of New York City, with the Oxley & Enos Manufacturing Company, of New York City, has been filed at Albany with the Secretary of State. The consolidated corporation will be known as the Oxley-Enos Company, and has a capital of $450,000. The directors are: W. F. Moody, Jr., of Cranford, N. J.; L. B. Franklin and C. F. Fuerstenburg, of Flatbush, and Thomas Plunkett and W. L. Scovil, of Brooklyn.

W. W. WHITEHEAD COMPANY, of Davenport, Iowa, report Corliss engine sales as follows: Deere & Mansur Company, of Moline, Ill., 22 by 42 by 48 tandem compound condensing; Chicago Brick Company, 24 by 48 condensing; Le Roy Mining Company, Rossland, B. C., 16 by 42; Northport Mining & Smelting Company, Northport, Wash., 16 by 36; Western Tube Company, Kewanee, Ill., 28 by 48; Parkersburg Iron & Steel Company, Pittsburg, Pa., 28 by 60, and the South Halsted Street Iron Works, Chicago, 18 by 42.

ALUMINUM FOR TELEPHONE WIRES.—The Sunset Telephone Company has started work on a new line from San Francisco to Fresno alongside of the Santa Fe Railroad track. The wire to be used will be the first of its kind put up in California for telephone work. It will be an aluminum cable of seven strands, or separate wires.

General News.

THE TELEPHONE.

ADAIRSVILLE, GA.—The Bell Telephone Company has decided to put in a long distance telephone at this point. The wire will be run ten miles from the main line, between Atlanta and Rome, to reach Adairsville.

ATLANTA, GA.—B. H. Veal is president of a new company which will soon complete a Bell telephone system in Austell, Ga., connecting with Atlanta. J. P. Woodson, of Atlanta, will construct the line at once.

CHICAGO, ILL.—A council committee will meet June 21 to listen to arguments by representatives of the Chicago Telephone Company concerning the question whether the telephone business is a natural monopoly. The question comes up over the proposed grant of the United Telephone & Telegraph Company, Chicago, Ill.

GREENCASTLE, IND.—Recent severe wind and electrical storms throughout this and adjoining counties greatly damaged and impaired the telephone service. The temporary suspension demonstrated to the many patrons the value and convenience of the service.

TERRA HAUTE, IND.—The linemen employed by the Central Union Telephone Company of this city have gone on a strike. The company conceded the wages asked, but refused to sign a contract with or recognize the Electrical Workers' Union, and then the men quit work.

INDIANAPOLIS, IND.—The Central Union Telephone Company has opened a supply station and established a plant in this city. Seventy men are employed. All the electrical appliances used by the company in the State will be distributed from the new station, and many of the appliances the company uses will be made here.

INDIANAPOLIS, IND.—Articles of incorporation have been filed by the Citizens Telephone Company of Brazil, capital stock $10,000, and the Farmers' Mutual Telephone Company of Elkhart, capital stock $5,000. The Home Telephone Company, of Columbia City filed additional papers increasing its capital stock from $10,000 to $25,000.

INDIANAPOLIS, IND.—The American Telephone & Telegraph Company is asking for franchises in a number of counties in the northeastern part of the State. C. M. Cole, of New York, is looking after the company's business in this State and had a conference with other representatives of the company in this city recently. The company, he said, is an Indiana corporation, but refused to divulge its plant. It is alleged that the company Mr. Cole represents is a part of the Bell Telephone Company, which has, it is said, filed articles of incorporation in other States as it has in Indiana; that it is the intention to build a line from Chicago to New York, and that it asks only the right to construct a line and one toll station in each county. It is understood that work on the line between Chicago and Pittsburg is to commence soon.

INDIANAPOLIS, IND.—The Secretary of State has been asked if telephone companies may be organized in Indiana on what is called the "Wisconsin Valley plan." This plan is strictly coöperative. Stock can be bought only by persons that rent telephones, and such persons can buy as many shares of stock as telephones rented by them, and no more. When a stockholder ceases to rent the company cancels his excess or entire stock and refunds to him its par value. The company binds itself to furnish stock to every renter of its service. It must also regulate its monthly charges so as to be able to pay a dividend of 1 per cent a month, to be credited to the monthly renter. As an illustration a rental of $2.25 a month for business houses and $1 for residences is charged, and a monthly dividend of 1½ per cent (75 cents) is credited on the rental account of each stockholder, hence he actually gets his business service for $1.50 and his dwelling service for 25 cents a month. There are no companies organized in Indiana on this plan, although there is no law forbidding such.

LOUISVILLE, KY.—The Home Telephone Company, of Louisville, Ky., a new independent company, has been granted a permit, and will begin work on a plant soon. It paid $10,000 for the franchise.

BOSTON, MASS.—The Erie Telephone Company's Lowell offices, have been moved to Boston and now occupy the ground floor in the Whittier building, 15 Exchange street. The president's and vice-president's office will remain for the present at 15 Congress street.

LANSING, MICH.—The Michigan Telephone Company is putting in a 200-line board at Mason.

DETROIT, MICH.—Articles of incorporation of the People's Telephone Company have been filed at Lansing. The capital stock is $2,500,000 and the stockholders are as follows: Henry A. Everett, Edward W. Moore, Arthur Pack, Joseph W. Martin, Theodore D. Buhl, Henry Stephens, Alex. McPherson, Charles L. Palms, George L. McPherson, John B. Corliss and J. C. Hutchins.

MAYSVILLE, MO.—The Dekalb County Mutual Telephone Company, of Maysville, with a capital stock of $5,000, has been incorporated by J. E. Roberts, Eugene De Hart, James B. Mays and others.

NEWARK, N. J.—Hudson & Middlesex Telephone & Telegraph Company, capital stock $15,000; formed to operate telephone lines, etc.; principal office, 164 Market Street, Newark.

BATAVIA, N. Y.—The construction of the Home Telephone line will be commenced in a few days. This company was incorporated a short time ago with a view of building a line to cover the entire village to be in operation by July 1. It has been granted a franchise by the village council.

SPRINGFIELD, OHIO.—The Springfield council has granted a franchise to the United States Telephone Company to build toll lines through this place.

MINERVA, OHIO.—The Minerva council has granted a franchise for a local toll station and exchange to the Stark County Telephone Company of Canton.

TROY, OHIO.—The Troy Telephone Company has increased its capital stock from $40,000 to $75,000 to provide for improvements. H. M. Allen is secretary of the company.

PIQUA, OHIO.—The Piqua Home Telephone Company has increased its capital stock from $75,000 to $100,000, to provide for improvements. D. Odell is manager of the company.

FOSTORIA, OHIO.—Manager A. R. Knabenshue, of the Central Union Telephone Company (Bell) states that the local exchange will be rebuilt and improved at an expense of $20,000.

CARDINGTON, OHIO.—The Morrow County Telephone Company has increased its capital stock from $12,000 to $30,000, to provide for improvements. M. L. Phillips is manager of the company.

COLLINWOOD, OHIO.—The Collinwood Home Telephone Company has increased its capital stock from $25,000 to $50,000 to provide for improvements. L. C. Ballinger is manager of the company.

SIDNEY, OHIO.—The Sidney Telephone Company has increased its capital stock from $40,000 to $60,000, to provide for improvements. W. H. Wagner is president and H. T. Mathias secretary of the company.

SPRINGFIELD, OHIO.—Farmers of Harmony township have organized the Home Telephone Company to build a farmer's exchange. C. A. Schneider, E. E. Hoge, and E. H. Campbell are the promoters. The capital stock is $10,000.

ASHLAND, OHIO.—The Star Telephone Company has commenced the work of rebuilding its exchange in this place. New apparatus will be installed throughout. A toll line is being built to Clearcreek township which will connect up about 50 farmers in that vicinity.

LIMA, OHIO.—The Lima Telephone & Telegraph Company has been incorporated with $150,000 capital stock, to operate telephone lines in Lima and throughout Allen County. Incorporators: W. L. Parmenter, Henry W. Neff, Kent W. Hughes, M. C. Purtscher, Joseph A. Dutton.

SPRINGFIELD, OHIO.—The Springfield Home Telephone Company, composed of local and Cleveland people, and the Springfield Citizens Telephone Company, composed wholly of local people, are having a hard fight for the franchise in this city. The matter will be decided in a few days.

XENIA, OHIO.—The Miami Telephone Company is rapidly completing its new exchange. The new switchboard has a capacity of 1000 and 700 subscribers have been secured. Country lines are being built to Cedarville, Jamestown, Spring Valley and surrounding villages. The rates will be $2 per month for business and $1 for residences.

CLEVELAND, OHIO.—In celebration of the completion of the connection made with the Pittsburg & Allegheny Telephone Company, giving through service from Cleveland to Pittsburg, the United States Telephone Company and the Cuyahoga Telephone Company gave free service to the public on June 10 and 11. Free service was given by the Pittsburg company on Cleveland connections on June 12 and 13.

TOLEDO, OHIO.—Despite the fact that it has not yet secured a franchise the Toledo Home Telephone Company, which is promoted by Frank Graves, and supposed to be backed by the Federal Telephone Company of Cleveland, is pushing matters with a view to commencing work as soon as possible. About 3000 subscribers have been secured and the company now agrees to give a rate of $24 per year for residence telephones. The company has leased two floors of the new Nasby building for an exchange.

PORTLAND, ORE.—The Western Union Telegraph Company recently strung a new wire from Portland, Oregon, to Vancouver, Wash. A new cable one mile in length will be laid at the crossing of the Columbia River.

MILLVILLE, PA.—The Enterprise Telephone & Telegraph Company, of Millville, having stations at Port Norris, Ocean City, Egg Harbor and Cape May, has sold its lines to the Interstate Telephone Company, of Philadelphia, which will connect the lines with Philadelphia and Pennsylvania towns.

BEAUMONT, TEX.—The Beaumont Telephone Company, of Beaumont, has been incorporated; capital stock, $60,000. Incorporators: Melville D. Shaw, Charles N. Haskell, James King Duffy, James E. Boynton, Charles H. Roser, Sheppard H. Van Wormer and William H. Aldridge, Texas.

MILWAUKEE, WIS.—The recently organized Citizens' Telephone Company is drafting a franchise to be introduced in the common council.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has been granted a franchise by the city of South Milwaukee to build a telephone system in that city. The system will be completed in about sixty days.

BELMONT, WIS.—The farmers' telephone line, incorporated under the name of the Belmont & Pleasant View Telephone Company, is about completed from Belmont to Pleasant View. The company will build the line to Darlington in a short time.

LA CROSSE, WIS.—The date of the semi-annual convention of the Wisconsin Independent Telephone Association has been set for June 26 and 27 at La Crosse. Plans will be made for a through telephone line between La Crosse and Milwaukee, and a movement to connect all independent lines between the two cities will be considered.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company is about to extend the private telephone system used on the railway system by adding several new stations and instruments. The telephone system is reported to be one of the most complete in use for railway purposes, and places the employes in direct communication with the general offices. The system is also used for interurban train dispatching.

ELECTRIC LIGHT AND POWER.

LIVERMORE, CALIF., is in darkness on account of a suit and attachment upon the plant of the Livermore Gas & Electric Light Company, levied by Wm. M. Mendenhall.

SAN FRANCISCO, CALIF.—The Nevada County Gas & Electric Company has been incorporated. San Francisco is named as the principal place of business. Directors: John Martin, F. H. Pierson, H. U. Roeding and W. M. Pierson. Capital stock, $100,000; subscribed, $500.

ALBANY, GA., will vote on a bond issue of $25,000 to erect a modern electric light plant. The city invested $25,000 in a second-hand plant several years ago, but this has not given entire satisfaction.

MASCOUTAH, ILL.—A special committee of the city council has been appointed to confer with the electric light company officials, with the view to the purchase of the company's plant.

CHICAGO, ILL.—Corporation Counsel Walker will be asked by the council to draw up a form of ordinance for small electric light companies who wish to get franchises in the downtown district. A number of block lighting companies are already supplying current to consumers in competition with the Chicago Edison Company.

FORTVILLE, IND.—J. K. Fautout, of Indianapolis, and Q. A. Wright, of this city, have secured a franchise for an electric light plant, the same to be in operation within ninety days.

FRANKFORT, KY.—Articles of incorporation have been filed by the Electric Light & Power Company, of Somerset, Ky., with $10,000 capital stock.

PARIS, MO.—The proposition to issue bonds for the purpose of building an electric lighting plant and water works was carried recently by the citizens of Paris.

ST. LOUIS, MO.—The board of education brought suit June 10 against the Imperial Electric Light, Heat & Power Company to compel it to put smoke consumers in its smoke stack and to raise a steam exhaust pipe so that the escaping steam will not blow against the wall of the plaintiff's building.

BATTLE CREEK, MICH.—The Northern Electrical Manufacturing Company of Madison, Wis., through its Chicago office, has secured the contract for the entire equipment of the new central station being built by the Citizens Electric Light Company of Battle Creek, Michigan. The installation will consist of one 275 and one 135-kw, two-phase Stanley inductor alternator, together with station and sub-station switchboards, step-up transformers, etc. The larger unit will be belted to a water wheel of about 250-hp, and the smaller one will be driven by a Buckeye engine. On account of the limited and uncertain water power available, it will be necessary to operate these generators in parallel, the smaller unit taking its load automatically in proportion to the power of the water wheel. This would mean that the water driven unit will at all times carry the bulk of the load; the engine driven unit only being called upon when the power of the water wheel falls below normal. These conditions have, however, been met and satisfactory results accomplished in many plants equipped with Stanley apparatus.

MT. AIRY, N. C.—A vote will be taken here on June 24 on the question of issuing bonds for waterworks and electric lights.

GREENSBORO, N. C.—The Greensboro Electric Company has filed articles of incorporation with the secretary of state; the authorized capital is $250,000. This company has the contract to light the city, and also holds a franchise for constructing an electric railway. John Karr and others are interested.

CONCORD, N. H.—The Concord Electric Company, formed to take over the property and business of the Concord Land & Water Power Company, has filed articles of agreement. The capital stock of the company is $400,000, and the incorporators are W. H. Whitney, Chas. H. Stone, of Boston; Fred C. Demond, Allen Hollis and Geo. L. Osgood, of Concord. The work of organizing the new company will now be proceeded with.

CAPE MAY, N. J.—The Cape May Electric Company has been incorporated. Capital, $100,000. Incorporators: Thomas Robb, Logan M. Bullitt and James M. E. Hildreth, Albany.

TRENTON, N. J.—The United Electric Power Company, capital $250,000, has been incorporated, to manufacture electricity. The incorporators are J. Dobson Good, J. H. Everett and K. K. McLaren, Jersey City.

TRENTON, N. J.—The Tuckerton Electric Company, of Haddonfield, N. J., has been incorporated; capital, $10,000. Incorporators: Ezra C. Bell, John H. Bell, Edwin R. Bell, M. W. Pharo, T. F. Pharo, J. W. Pharo, A. E. Pharo.

BUFFALO, N. Y.—The Depew & Lancaster Light, Power & Conduit Company has increased its capital from $20,000 to $75,000.

ROCHESTER, N. Y.—The Citizens' Light & Power Company is erecting a new generating plant in this city, of 10,000-hp capacity. The eight water-tube boilers will be equipped with automatic stokers. The engine room will contain five 1800-hp, vertical, cross-compound engines, made by the Southwark Foundry and Machine Company. These engines will be directly connected to sixty cycle, two-phase alternators, of about 1400-kw capacity each. There will be also one horizontal, cross-compound engine of 750-hp, made by the Dixon Manufacturing Company, of Scranton, Pa. This engine will be directly connected to a 500-kw, 60-cycle, Stanley induction alternator. The generators will have a uniform voltage of 2200.

NILES, OHIO.—The city council has decided to sell its lighting plant at public sale and has determined on a levy of 11.5 mills for next year's funds.

WELLSVILLE, OHIO.—The Wellsville Electric Light Company has increased its capital stock from $30,000 to $100,000 to provide for improvements.

DELAWARE, OHIO.—The Stratford Paper Mill property has been bought by the Columbus, Delaware & Northern Electric Railway Company for $2700. The new power house, to cost $90,000, will be located there.

TOLEDO, OHIO.—At the time of the organization of the Toledo Heating & Lighting Company, two years ago, those who took $50,000 or more of the bonds of the company at par were given the same amount gratis. For a long time the stock was considered of little value. Of late the record of the organization has been remarkable, and within a few days 80 has been bid and refused for a block of stock. Several months ago a block of $20,000 worth sold at 70.

ELYRIA, OHIO.—The Elyria Gas & Electric Light Company has secured an option on the Lorain Gas Company's plant at Lorain, and it is the intention to build large electrical plants at both Elyria and Lorain to supply both places as well as neighboring villages. Alternating current apparatus will be installed and the plants will be connected so that either one or both can be operated to carry the load of both towns.

MONTREAL, QUEBEC.—At a recent meeting of the city council, a long petition was read from the Shawinigan Water & Power Company, setting forth that the company was ready to expend large sums of money in the development of electrical power; that a transmission line was shortly to be constructed from Shawinigan Falls into the city of Montreal, and that the company was anxious to get an entrance into the city. In order to distribute power and light in Montreal, it was necessary that the petitioners have the right to enter the city with their pole lines and wires.

QUEBEC, QUE.—Letters patent have been granted a new electric company in the Province of Quebec. The purpose of the company is to develop water powers and to manufacture and supply electricity for the purposes of light, heat and power; and moreover, to be vested with all the powers conferred upon the Canadian Electric Light Company, viz.: the power to furnish electric light, motive power and heat and other advantages to be derived from electricity, to the cities, towns and municipalities in Quebec Province, lying west of, and including, the city of Three Rivers. The new company will operate under the name of "The Provincial Light, Heat & Power Company, with a capital stock of $500,000.

CULPEPER, VA.—The city council has voted a ten-year franchise to J. M. Spotts, of Staunton, Va., to erect and operate a plant to furnish electric lights to the city and citizens. Mr. Spotts has an option on the franchise until Aug. 30 next.

RICHMOND, VA.—The Richmond Industrial Development Company, capital $50,000, is a projected enterprise, which will erect a manufacturing building to be leased to small manufacturers. The building will be furnished with light and power. John L. Williams & Sons, Joseph Bryant, and others are interested.

MILWAUKEE, WIS.—The fire department has petitioned the common council to have search lights added to its equipment.

RIPON, WIS.—It is reported that an option on the Ripon Light and Water plant has been secured from the stockholders, and that the city is likely to become the owner of the plant and manage the same on public account.

MILWAUKEE, WIS.—The Julius Andrae & Sons Company has been awarded the contract for the electric lighting and power plant for Kroeger Brothers' new department store. The equipment will include one 75-kw and one 40-kw direct-connected units, complete switchboard, iron pipe conduit system and wiring to 1000 incandescent and 70 enclosed arc lamps, three 15-hp motors and one 10-hp motor. The plant will be modern in every detail.

THE ELECTRIC RAILWAY.

BALTIMORE, MD.—The directors of the Washington & Annapolis Electric Railway have effected a permanent organization. W. H. Lamprecht was elected president, Otto Miller secretary and treasurer and James Christy vice-president. The directors are: W. H. Lamprecht, Otto Miller, Frank N. Wilcox, F. T. Pomeroy and E. W. Moore, of Cleveland; James Christy, Jr., of Akron, Ohio, and Wm. L. Marbury, of Baltimore. The line from this city to Washington will be a little more than 30 miles long.

BOSTON, MASS.—On the application of the International Trust Company of Boston, H. B. Rice, of Houston, Tex., was appointed receiver of the property of the Houston Electric Street Railway Company, which company owns the entire street railway system in the city of Houston. The proceeding is one to foreclose the consolidated 5 per cent mortgage of the railway company because of its default in the payment of the interest on its bonds and the general insolvency of the company.

DETROIT, MICH.—The sale of the Detroit and Pontiac suburban trolley line to the Detroit United Railroad was consummated on June 1. From now on the road will be run as part of the United Railroad system. The purchase is said to be another step toward a consolidation of all the suburban trolley lines with the Detroit United Railroad Company.

ALBANY, N. Y.—The New York & Port Chester Railroad Company, with a nominal capital of $250,000, has been incorporated to construct and operate a trolley line from Willis Avenue Bridge to Port Chester.

PENN YAN, N. Y.—A company was organized at Keuka for the purpose of constructing an electric road from Dundee to Bradford, a distance of sixteen miles. The necessary $16,000 for incorporation was secured and the company was organized by the election of Hon. George P. Lord, of Dundee, president; Hiram Munson, of Bradford, vice-president; R. S. Harpending, of Dundee, treasurer, and E. M. Sawyer, of Dundee, secretary.

NORTH BALTIMORE, OHIO.—The council has granted a franchise through this place to the Findlay Street Railway Company.

FREMONT, OHIO.—The Kerlin Bros. Company, who are building a line from Fremont to Port Clinton are advertising for large forces of men, and announce that construction work will start at this end at once. Much grading has already been done at Port Clinton.

FINDLAY, OHIO.—The stockholders of the recently incorporated Findlay-Marion Electric Railway Company have organized as follows: Directors, W. E.

Schofield, Marion; Asa W. Jones, Youngstown; M. A. Smalley, of Toledo; Allen Smalley, of Upper Sandusky; P. B. Morrison, David Joy and Jason Blackford, Findlay; J. H. Ruhlman, of Youngstown; President, W. E. Scofield; Vice-President, Asa Jones; Secretary, Jason Blackford; Treasurer, P. B. Morrison.

NORWALK, OHIO.—W. T. Forsyth, engineer for the Sandusky, Bellevue, Monroeville & Norwalk Railway Company, states that the company has secured additional backing, and the road will be pushed to completion. Much work was done on the line last year; the power house being practically completed, but thus far this year nothing has been done. The line is being built by the Indestructible Roadbed Company, and it is said to be backed by Philadelphia capitalists.

CELEVLAND, OHIO.—At Detroit week before last Messrs. H. A. Everett and E. W. Moore instituted the first street car dining service ever operated in this country—so they claim. The gentlemen were making an inspection of the Rapid Railway from Detroit to Port Huron, and it was found it would be impossible to make the return trip in time for luncheon. The difficulty was overcome by engaging a chef from a hotel, who with the aid of a large oil stove and a goodly supply of food, served a bountiful repast while the car was en route.

EASTON, PA.—It is rumored here that the Union Traction Company, which operates all the trolley lines in Philadelphia, has absorbed the Lehigh Valley Traction Company, which controls and operates the Easton Transit Company's and other trolley roads in this locality.

MONTREAL, QUE.—Montreal capitalists, who control the Gatineau and Pontiac railways and the new inter-provincial bridge connecting the cities of Ottawa and Hull, are negotiating for the purchase of the Hull and Aylmer Electric Railway, which will enter Ottawa over the new bridge when the Montreal people get control. It is said that the price asked for the electric road is $1,000,000.

BALLSTON, SPA.—The stockholders of the Ballston Terminal Electric Railroad voted to increase the capital stock from $300,000 to $1,500,000, and to increase the bond issue from $200,000 to $1,200,000. The road will be extended from this village to Amsterdam, a distance of twenty miles.

RICHMOND, VA.—The Hampton Roads Railway and Electric Company, holding a franchise to construct its roads in Newport News, Va., and to extend to Old Point, has, it is understood, purchased $40,000 worth of electrical machinery for the new power house, now nearing completion.

SHEBOYGAN, WIS.—A new rail joint has been patented by J. Trilling and M. Wensauer. An offer has been refused for the purchase of the patent.

FOND DU LAC, WIS.—The Fond du Lac Street Railway Company will install a private dispatching telephone system in connection with its railway.

KAUKAUNA, WIS.—The common council has granted a franchise to the Wisconsin Traction, Light, Heat & Power Company for an electric road in the city.

RACINE, WIS.—The Milwaukee Electric Railway and Light Company has asked the Common Council for franchises to built its railway on several streets.

WAUSAU, WIS.—The Wisconsin Valley Electric Railway Company is making arrangements to build a interurban electric railway between this city and Merrill.

KENOSHA, WIS.—P. J. Haynes and G. L. Claussen, of Chicago, are seeking a franchise to build an inter-urban electric railway from this city to Lake Geneva, a distance of about eighteen miles.

MILWAUKEE, WIS.—The Sauk County Traction and Power Company has been incorporated by T. Hamilton, H. Green and T. C. Carter. The company is empowered to maintain and construct telephone and telegraph lines, and also to deal in electric light, heat and power.

NEW INDUSTRIAL COMPANIES.

THE INTERNATIONAL ELECTRIC SYNDICATE, of New York City, has been incorporated at Dovel, Del., with a capital of $500,000.

THE EWART RAILWAY SUPPLY COMPANY, capital $24,000, to manufacture electrical supplies, has been incorporated under the New Jersey laws.

THE AUTOMATIC BOOT BLACKING MACHINE COMPANY, of New York City, has been incorporated, to manufacture machines to polish shoes by electricity; capital stock, $2,000.

THE WHEELER-GREEN ELECTRIC COMPANY, of Rochester, N. Y., has been incorporated; capital, $4,000. Directors: W. J. Dadee, Clarence Wheeler and T. H. Green, of Rochester.

THE SCIENTIFIC & ELECTRICAL EXCHANGE, of New York City, has been incorporated; capital, $25,000. Directors: W. F. Thompson, of New York City; A. E. Hartcorn, of Brooklyn; F. S. Cutler and W. D. W. Miller of Plainfield, N. J.

THE AUTOMOBILE.

AUTOMOBILE RACES.—The Automobile Club of New England held its first annual races at Clyde Park, on June 16. There were eight races and in every event a contesting machine broke down and in most cases the winners went over the track alone after the first lap. The race of the day was the last one, which was between the three winners making the fastest time in the previous races. This brought together K. A. Skinner, on a gasoline tricycle; J. T. Robinson, Jr., on a gasoline machine, and A. L. Riker, on an electrical racer. The five miles were covered in 8:47 4-5, Riker winning by a small margin. The first race, open for electric pleasure vehicles, two and one-half miles, was won by A. L. Riker, of New Jersey, in 9.17 3-5. There were two entries in the second race, which was for electric machines, Riker winning easily. The distance was five miles, which was covered in 9:07 2-5. The third race, five miles, open to two-passenger steam rigs, was won by J. E. Griffin in 12:41. The fourth race, five miles, open to four-passenger steam rigs, was won by H. McLaughlin in 16:09. The fifth race, for club members only, on gasoline pleasure vehicles, was won by T. J. Robinson, Jr. His time was 12:31 2-5. The sixth race, open to steam racers, was won by T. E. Griffin. His time was 11:42 2-5. The seventh race, open to motor tricycles, was won by K. A. Skinner in 8:30 4-5.

OBITUARY.

MR. JOHN WARING.—It is with deep regret that we note the death of Mr. John Waring, from accident, at Hartford, Conn. He was president of the Franklin Electric Manufacturing Company, well known as manufacturers of incandescent lamps, and an explosion of gasolene occurred on June 14 in their laboratory, a small building detached from the main factory. Although his own clothes were on fire, he went back bravely to rescue two of the girls in the experiment room, and in doing so, apparently inhaled the flames. He was taken to the Hartford Hospital, and hopes were entertained of his recovery, as his burns were not serious, but he sank rapidly and died on Sunday afternoon. Mr. Waring was only 39 years of age, and a graduate of Cornell University. About ten years ago he went to Hartford, and while there brought out the Waring vapor incandescent lamp, once well known in the field of lighting litigation. He was afterwards connected with the Mather Electric Company, and later with the Perkins Electric Switch Company. About a year ago the Franklin Electric Company was formed, in which he was president, with C. I. Hills as vice-president and Jonathan Camp as secretary and treasurer, and he was busily engaged in the development of the concern's product and business, bringing to bear the inventive ability that always marked his work. Mr. Waring had been a member of the American Institute of Electrical Engineers since 1890, and was greatly esteemed, although of reticent disposition. In speaking of his death one of the Hartford papers says: "His humanity and bravery were shown at the fire. It is certain that he would not have lost his life but for his brave and knightly act." Mr. Waring leaves a mother and sister. We present herewith the last portrait of him in our possession.

LEGAL.

TELEPHONE PATENTS.—As we go to press, we are informed that a decision was rendered June 7 in favor of the Western Electric Company, in the United States Circuit Court of the Eastern District of Missouri, on Patent No. 438,788, and that in the same court a decision was rendered upholding the Seely patent on the employment of answering springjacks in multiple switchboards. Both of these suits were brought by the Western Electric Company against the Kinloch Telephone Company of St. Louis. The apparatus found to infringe patent No. 438,788 is the carbon plate protector, manufactured by the Sterling Electric Company. The apparatus found to infringe the Seely answering jack patent is the multiple switchboard built by the Kellogg Switchboard & Supply Company, of Chicago.

BELT CONVEYOR PATENTS SUSTAINED.—On Oct. 15, 1900, the suit of Robins Conveying Belt Company, of New York, against the Exeter Machine Works was argued before Judge Wheeler, of the United States Circuit Court for the Southern District of New York. The Robins Conveying Belt Company maintained that the Exeter Machine Works had infringed letters patent Nos. 499,472, dated June 13, 1893, and 571,604, dated Nov. 17, 1896, both of which are the property of the Robins Conveying Belt Company. On November 15, 1900, Judge Wheeler issued an interlocutory decree establishing the validity of the patents in question, and granted an injunction against the Exeter Machine Works. An accounting was ordered before Special Master John M. Shields, whose report, dated March 6, 1901, awarded damages to the Robins Conveying Belt Company.

JERSEY TROLLEY TAXES.—The Supreme Court of New Jersey has decided the case of the Mayor and Aldermen of Newark against the North Jersey Street Railway Company, holding that street railway franchises in New Jersey are taxable as real estate, thus adding to the State revenues several millions annually. This is considered an important opinion, as it will affect every city, township, and borough throughout which a trolley road passes. It is thought it will prevent the building of some small trolley roads for which franchises have already been granted. In the opinion the court holds that as between Newark and the company the latter has acquired the right to lay in the soil the foundation for its rails, to lay rails thereon, and the right to the continuous uninterrupted occupancy of such part of the public estate. Its poles and tracks are there permanently to the exclusion of any others who might desire to use the land, and during the life of the franchise the city is without power to remove them. The part of the street used by the company must be of the same character as the whole. Therefore, the estate being valuable to the city, is taxable the same as the balance of property. Lawyers say that the decision is sweeping in its scope. For instance, one lawyer said that under the form of contract now used by the Lighting Trust, by which for the life of its contract the contracting municipality is barred from allowing any company to string wires or lay gas mains, every pipe and conduit is taxable as real property. It was also said that private meter companies would have to be taxed for their pipes, hydrants, etc.

PERSONAL.

DR. FREDERICK BEDELL, of Cornell University, will spend the coming year in Europe.

MR. W. S. BARSTOW, general manager of the Brooklyn Edison Company, has resigned from that position, his resignation taking effect immediately.

PROF. MORGAN BROOKS has resigned from the chair of Electrical Engineering at the University of Nebraska to accept a similar appointment at the University of Illinois.

MR. A. A. KIND, Jacksonville, Fla., has become associated with George C. Pease & Company, in connection with steam and electrical installations of all kinds. In addition to recent installations of Harrisburg engines, etc., they have been engaged on a complete overhauling of the plant of the Aragon Hotel at Jacksonville.

HUTCHISON-POMEROY.—The marriage took place on May 31 of Miss Martha Pomeroy, daughter of Mrs. John W. Pomeroy, to Mr. Miller Reese Hutchison, in this city. Mr. Hutchison has of late become widely known in connection with telephonic work, and with efforts for enabling the deaf to hear even faint sounds.

CAPT. SAMUEL REBER of the Signal Corps has been appointed Military Secretary to Lieut. Gen. Miles, with the rank of Lieutenant-Colonel, to succeed the late Lieut. Col. Francis Michler.

GENERAL A. W. GREELY, Chief of the Signal Service, U. S. A., left San Francisco on the last trip of the Transport Sheridan. He is bound for Manila and will inspect the telegraph lines and the extensive submarine cable system which have been constructed in the Philippine Islands.

MR. F. B. H. PAINE, a prominent official of the Westinghouse Electric Company, has been in Ottawa on business with Messrs. Ahearn & Soper, the Canadian agents of the company. Mr. Paine inspected the electrical development of the city and expressed himself as highly pleased with it.

MR. WALTER SCOTT STROWGER, of Rochester, N. Y., the inventor of the automatic telephone switch which gave rise to the automatic telephone exchange now in use in several localities, has, it is stated, just invented an electrical storage battery that he says beats anything of the kind. He also has invented, to go with this battery, a substance to take the place of the India rubber casing, which is superior to rubber for the purpose, and is 90 per cent cheaper and more desirable.

MR. JOHN E. WARD, vice-president of the Gold Car Heating Company has just returned to New York from a Western trip, on which he secured a large order for the Chicago Elevated for electric heaters. He is greatly pleased over a recent decision by the Court of King's Bench on appeal, holding that the Gold straight post coupler does not in any way infringe the coupler covered by the Sewall Canadian patent No. 26,601. Mr. Ward was himself a witness in this case in Canada, where the Gold people have built up a very large business, now free from interruption.

JUDGE J. M. THOMAS.—The report has been circulated in Cleveland that Judge J. M. Thomas, general manager of the United States Telephone Company has handed in his resignation to accept the position of president of the Telephone, Telegraph & Cable Company of New York, and that he will be succeeded by Mr. Maxime Reber, at present consulting engineer of the properties of the Federal Telephone Company. It is stated authoritatively that Judge Thomas has not yet accepted the proposition from the New York company, and it is probable that the matter will not be decided upon for several weeks.

MR. C. T. YERKES.—An incident in the early Chicago career of Charles T. Yerkes, who has recently acquired the London roads, says the New York *Times*, serves to illustrate one phase of his character. There was in existence some time after Mr. Yerkes's arrival in Chicago a newspaper which derived its revenue largely through not printing articles. Such articles were prepared about public men, and were couched in such terms that the men to whom they were submitted by the publisher of the paper or his confidential agent in many instances bought the "copy" for round sums. A story of this type was written about Mr. Yerkes, and the publishers' agent called on the prospective victim, handed him the article, and asked if it should be printed. Mr. Yerkes replied: "Print it." Two days later the publisher called in person and attempted to reopen negotiations, pointing out that the article was worth several thousand dollars to him, and winding up by asking Mr. Yerkes: "What would you do about it?" Mr. Yerkes opened a drawer in his desk, began toying with a pearl-handled revolver, and replied: "Print it! By all means print it; but first find some one to run your paper the day after it appears."

EDUCATIONAL.

ELECTRICAL LABORATORY IN ATLANTA.—Work has been started in Atlanta, Ga., on a new electrical laboratory at the Technological School, which will cost $17,000. The structure will be three stories high, 93x83 feet and will be constructed of brick and slate.

THE MICHIGAN COLLEGE OF MINES is at present planning for the erection of two much needed buildings, which have been provided by the Legislature of the State. One of these is to be for the department of civil and mining engineering, and the other for the department of chemistry and metallurgy. The mining engineering building will provide mining and hydraulic laboratories together with lecture and class rooms, all equipped with modern appliances. The amount allowed for its construction and equipment is $42,500. The building devoted to chemistry and metallurgy with its equipment will cost $35,000. Its laboratories will be fitted up in accordance with modern ideas of lighting, plumbing and ventilation. The appropriation provides also for an addition to the present engineering building which will accommodate the course in blacksmithing. The equipment of the electrical laboratory will be extended and the central heating plant enlarged, to take care of the added buildings. The college is closing one of its most prosperous years, with an enrollment exceeding that of any former year.

Trade Notes.

CHANGE OF NAME.—The Graham Brothers Mfg. Company, Chicago, Ill., has changed its title to National Gas & Electric Company.

RED BOOK.—The Peru Electric Manufacturing Company, Peru, Ind., is getting out a new issue of its catalogue, which it calls the "Red Book."

THE ELECTRIC APPLIANCE COMPANY, Chicago, is putting out a new dry battery under its well known name "Eaco," which it especially recommends for telephone work, and where heavy service is required.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is sending out a most complete catalogue of telephone and annunciator systems for hotels, factories, apartment buildings, etc. Copies will be sent upon application.

ALASKA CABLE.—The new Government telegraph cable, from Skagway to Juneau, Alaska, will be laid by W. R. Brixey. Some of the members of the cable laying expedition are expected to arrive in San Francisco in the near future.

THE EMERSON ELECTRIC MFG. COMPANY reports an unusual demand for alternating current desk and ceiling fans. The Emerson Company is now making 23 distinct types of desk, ceiling and exhaust fans for use on alternating current circuits.

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, has recently installed several Cross oil filters in the New York City public school buildings. Their field is unlimited, and they show a saving wherever oil is used for lubrication.

HYLO LAMPS are carried in stock by the Central Electric Company, of Chicago. This is a double filament regulating lamp, which is being advertised extensively. Besides being economical, it is found very convenient as an all-night light in halls, bath rooms, sick rooms, etc.

TURBINES.—The Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio, has recently made a shipment of nine carloads of water wheels to the Remington-Martin Company for a paper mill at Norfolk, N. Y. The total power to be developed is 4375-hp when working under a head of 42 feet of water.

THE STANLEY ELECTRIC MANUFACTURING COMPANY has moved its general offices and the engineering department to its new quarters at Pittsfield, the new works. Several of the other departments are also installed in the new buildings and by the end of June the new works will probably be completely occupied.

"THE ELECTRIC AUTOMOBILE A SYMBOL OF PROGRESS." The June issue of *The World's Work* contained an article under the above title, by Herbert Sherman Houston. This interesting article has been reprinted under the regular cover of *The World's Work*, by the Electric Vehicle Company, and makes an excellent addition to automobile literature.

THE NEW BRITAIN MACHINE COMPANY, New Britain, Conn., has issued a catalogue illustrating and describing a large line of machine shop furniture in iron and steel. This line embraces fifteen different styles of tool racks in two sizes, four sizes of lathe pans and shop shelving, and a new type of lathe rack and oil feeder.

TRAVELLING LINK GRATES.—The Green Engineering Company, Western Union Building, Chicago, Ill., in its Catalogue "B" illustrates and describes the Green travelling link grates. Views of several boiler plants equipped with these grates are shown. All managers of steam plants will be interested to investigate the merits of this system of stoking.

THE CENTRAL ELECTRIC COMPANY, of Chicago, has issued a new wire price list dated June 17, in which is listed I. X. L. weatherproof wire, galvanized telephone wire, annunciator, office and magnet wires and lamp cord. This company will be glad to receive inquiries from those interested in this material and will be pleased to send copy of price list upon request.

COLUMBIA GASOLINE RUNABOUTS are the subject of a tasteful and useful pamphlet in oblong pocket form just issued by the Electric Vehicle Company. It not only gives an abundance of descriptive material but has three admirable sheets of lettered drawings at the end. The company is able to show some excellent reports on the operation of these mark eights.

THE CROCKER-WHEELER COMPANY, at Ampere, N. J., reports that the strike of its machinists has petered out completely. The company offered good terms, took a firm stand and then found an abundance of outside help. Toward the end of last week many of the old hands sought to secure their former jobs. The company is now shipping its motor products as usual. Dr. Wheeler anticipates no further trouble.

THE HARTFORD ELECTRICAL SUPPLY COMPANY has just secured a $35,000 contract for underground cable work, including service and conductor wires, for the Hartford Electric Light Company. This company has not been long in business, but has taken some of the largest contracts in Connecticut and the adjoining territory for electrical equipment. The officers are: C. C. Cook, president; F. W. Bartlett, secretary, and F. E. Bartlett, treasurer.

KILFYRE.—The Monarch Fire Appliance Company, 27 William Street, New York, in an 8-page pamphlet gives a number of illustrations showing the application of "Kilfyre in the extinguishment of fires. This fire extinguisher consists of a dry powder put up in a metallic tube. A sudden jerk on the tube when hung up releases the cover, which remains hanging on the hook, thus leaving the tube open at the upper end and its contents free for instant use.

A COURSE IN DRAWING, designed especially to meet the requirements of teachers, has been prepared by the International Correspondence Schools, Scranton, Pa. Drawing is of considerable importance to teachers, a number of States requiring applicants for teachers' certificates to pass an examination in it, and it is probable that other States will do likewise. The schools' drawing course will qualify teachers not only to pass such examinations, but to fill positions successfully as instructors in drawing.

THE UNITED STATES CARBON COMPANY.—Mr. W. D. Sayle, receiver for the United States Carbon Company, of Cleveland, states that in the

near future the company will undoubtedly be taken out of the hands of the receiver and will be reorganized by prominent Cleveland business men. He states that the plant is equipped to economically turn out 150,000 carbons per day, and that the business on hand indicates that the continuation of operations on present lines would yield a large profit.

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., has recently taken the exclusive territorial agency for the Browning spherical steel-clad motors and dynamos. These machines are made in sizes of from 1-5 to 3½-hp and ⅛ to 2½-kw. The motors were designed to be used where a high grade, strong and compact machine was necessary, and are especially adapted for all small power work, for manufacturers, jewelers, hotels, clubs and restaurants, or for small private lighting plants. Catalogues are to be had on application.

CHAS. H. BESLY & COMPANY, 10 North Canal Street, Chicago, announce the recent shipments of complete shop equipments to points in Illinois, Indiana, Ohio, Wisconsin and Minnesota. They have just received an order from the Rock Island arsenal for several hundred vises, cutters, reamers and other small tools. Their factory at Beloit, Wis., is being worked overtime in order to fill orders for their general line of products. The firm states that it is selling more Gardner grinders now than ever before. A 300-page illustrated catalogue can be had on application.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, has recently gotten out two attractive bulletins covering fan motors and ceiling fans for direct and alternating currents. It is offering for direct current the now well-known peerless ceiling and desk fans. The 1901 model of these fans embodies a large number of improvements both in inside construction and artistic outside designs. For alternating current it is offering the well-known Emerson desk and ceiling fans. Special attention is called to the Parker noiseless blades, with which all these fans are equipped.

PULVERIZED FUEL.—A handsome pamphlet issued by the Engineering & Powdered Fuel Company, Land Title Building, Philadelphia, Pa., is devoted to the subject of pulverized fuel and its uses. In this system the fuel is finely powdered and fed into the furnace along with the air required for combustion, through a special form of burner attached to a special type of door built to replace regular firing doors. A sheet accompanying the pamphlet gives tabulations of some tests made on pulverized fuel, the results of which show a considerable economy over usual methods of furnace firing.

THE FALCON FAN MOTOR for direct current is one of the leading fan motors on the market. It is made in three sizes, 12-inch, 15-inch and 18-inch, finished in black enamel with polished brass fan and guard. In operation this fan is perfectly noiseless and is provided with universal joint, which makes it adjustable to either wall or desk use. The Central Electric Company, of Chicago, are agents for this fan motor, and will be pleased to send to anyone upon request their 1901 fan motor catalogue describing the Falcon, as well as numerous other fans, which include direct and alternating current desk and bracket and ceiling fans, also battery fan motors.

PRIVATE BRANCH EXCHANGE TELEPHONE SERVICE.—The New York Telephone Company has issued an artistic brochure on the subject "Branch Exchange Telephone Service," in which is given a description of the use of this service, together with many illustrations. The popularity of this service is evidenced by the fact that there are at present over 1200 private branch exchanges in New York, the equipment ranging from 2 to 22 lines, and from 2 to 180 stations. Users of such service embrace almost every line of business, including publishers, newspapers, hotels and apartment houses, over 100 hotels and apartment houses being equipped with private branch exchanges.

REDUCING FUEL COST.—The opportunity for reduction in fuel cost in a small boiler plant is well illustrated by a statement made by the Eagle Machine Works, of Memphis, Tenn., in a recent letter to the B. F. Sturtevant Company, of Boston, manufacturers of the forced draft fan outfit, to the effect that "the boiler is estimated at 85-hp and hard worked. The blower is driven from a line shaft and the main air pipe is connected to the ash-pit to act on the forced draft principle. Soft coal is used. The saving according to the statement of the owners is $3.00 a day, and is caused by the difference in the price of coal. Formerly they used coal at $2.85, now they use coal at $2.25 per ton. The amount of coal used is the same. Formerly they were often short of steam, now they have plenty of it."

MR. W. G. CLARK, of Seattle, Wash., was a visitor to New York last week. Mr. Clark is manager of the Kilbourne & Clark Company, composed of C. A. Kilbourne and W. G. Clark, both of whom have had extensive experience in electrical work as contractors, construction agents, representatives and selling agents. The corporation is, however, a new one and already represents in its section manufacturers of gas and electric fixtures, electric lighting, street railway and telephone supplies as well as generators, power motors, wires, cables, etc. There is seemingly a large opportunity for sales in the section of which Seattle is naturally the centre and the company could represent one or two manufacturers of specialties not already handled by it, who may be desirous of securing live representatives in that territory.

STERLING ELECTRIC COMPANY, of Lafayette, Ind., show phenomenal growth in output. Its factory was removed from Chicago December, 1899, occupying a building comprising 50,000 square feet of floor space. The growth was such that in January it purchased an additional building of like size, giving it something over 100,000 square feet of floor space. It is constantly equipping it with new machinery to facilitate the handling of its constantly increasing business. Its work has so grown into the multiple switchboards, and full common battery systems, that it has increased its capital stock to $150,000 to enable it to handle this additional new work. It is recognized as standard throughout the independent field, and its switchboards, protective devices, terminals and telephones have a wide reputation.

NEW TELEPHONE FUSE.—The American Electric Fuse Company, of New York, has just perfected a new telephone fuse. This fuse resembles in appearance the old style of fuse, manufactured by this company, but the fuse wire is enclosed between two pieces of mica, thus preventing any possibility of breakage. The fuse wire is left loose in the middle of the fuse, so that it fuses completely. The fuses are furnished in any amperage desired for telephone work, either in Western Union or Postal style. The company has made a large number of tests in order to secure the perfection of this device and announce that samples of these fuses are now ready for the market. They are moisture proof, indestructible, and will last a lifetime, unless burned out. The fuse will fit any standard block on the market, and can be furnished in any special shape or design required.

EXPOSITION INFORMATION BUREAU.—In view of the large number of students who will visit the Pan-American Exposition, the International Correspondence Schools, Scranton, Pa., have established an information bureau at their Buffalo office. Arrangements have been made to secure accommodations both in the hotels and private families during the Exposition. The Schools state that no rooms can be secured at less than $1.00 per night for each person, and that persons wishing rooms held for them must forward remittance to pay for the time the rooms are wanted. The information bureau is conducted free of charge. All correspondence intended for the information bureau should be addressed to the International Correspondence Schools, Ellicott Square Building, Buffalo, N. Y. Students and others visiting the Exposition are invited to call at the Buffalo office.

ROTH BROTHERS & COMPANY.—It is not often that Roth Brothers & Company, of Chicago, builders of dynamos and motors, blow their own horn. Yet they wish to announce that in the past month they have doubled their floor space, added much new machinery and increased their working force, which was absolutely necessary to keep up with the demand they are having for their motors and dynamos. This company also makes a specialty of battery charging motor dynamos and power ringers for telephone exchange service. These machines can be found in many of the principal telephone exchanges throughout the United States, are also on exhibition at the Pan-American. Under construction at their shops at the present time are telephone power machines for Milwaukee, Wis.; Clinton, Iowa; Oskaloosa, Iowa; Owensboro, Ky., and others for telephone manufacturers, destination not known.

THE BLOWER SYSTEM OF VENTILATION AND HEATING.—The particular features of this combined system of ventilation and heating in which a fan is employed to distribute the heated air are thus summarized in a recent lecture lecture by Walter B. Snow, of the engineering staff of the B. F. Sturtevant Company, Boston, Mass.: "The entire heating surface is centrally located, enclosed in a fireproof casing, and placed under the control of a single individual, thereby avoiding the possibility of damage by leakage or freezing incident to a scattered system of steam piping and radiators. The heater itself is adapted for the use of either live or exhaust steam, and provision is made for utilizing the exhaust of the fan engine, thereby reducing the cost of operation to practically nothing. At all times ample and positive ventilation may be provided with air tempered to the desired degree. Absolute control may be had over the quality and quantity of air supplied. It may be filtered and cleansed, heated or cooled, dried or moistened at will. By means of the hot and cold system, the temperature of the air admitted to any given apartment may be instantly and radically changed without the employment of supplementary heating surface."

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED JUNE 11, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, 177 Times Bldg., N. Y.]

675,878. ELECTROGRAPH; M. Beck, Minneapolis, Minn. App. filed Aug. 8, 1899. Apparatus for transmitting pictures in which the transmitter contains a plate coated with material whose resistance is affected by varying shades of light and a receiver having a plate coated with material variably affected by the current of varying intensity, suitable tracers moving synchronously being also provided.

675,894. PRINTING TELEGRAPH; F. H. Littlefield, St. Louis, Mo. App. filed June 18, 1900. A perforated tape is fed to the transmitter, and the receiver perforates in a similar manner another tape, after which suitable selecting devices complete a circuit through a printing magnet for each combination of perforations in the tape and thus print a letter.

675,895. PRINTING TELEGRAPH; F. H. Littlefield, St. Louis, Mo. App. filed Feb. 23, 1901. An improvement on the preceding invention.

675,918. STORAGE BATTERY; V. G. Apple, Dayton, Ohio. App. filed Nov. 1, 1900. (See Current News and Notes.)

675,931. ELECTRIC METER; L. E. G. Cauro, Naples, Italy. App. filed Dec. 31, 1897. Details.

676,006. RECEPTION AND RETRANSMISSION OF ELECTRICAL IMPULSES; A. Muirhead, Shortlands, Eng. App. filed Feb. 20, 1901. An improvement in sub-marine telegraphy, whereby the effect of any prolonged contact made by the receiving relays is converted into the same number of separate impulses as those originally transmitted, notwithstanding the fact that the receiver coil itself remains on one contact during the whole period.

676,035. SYSTEM OF ELECTRIC PROPULSION; H. Halberstadt, Kenosha, Wis. App. filed Jan. 26, 1900. A trolley pole projects downward from each platform of the car to a third rail.

676,043. ELECTRIC DRILL; J. C. Lincoln, Cleveland, Ohio. App. filed Nov. 22, 1899. The drill is sustained in position by an electro-magnet, the inven-

tion residing in the means for accurately adjusting the position of the drill point.

676,068. INCANDESCENT ELECTRIC LAMP; L. Lobenthal, New York, N. Y. App. filed Oct. 11, 1900. A two-filament lamp which can be adjusted to any single filament socket, means being provided for cutting in either filament at will.

676,069. INCANDESCENT ELECTRIC LAMP; L. Lobenthal, New York, N. Y. App. filed April 1, 1901. Details of a switch used in the preceding lamp.

676,074. INCANDESCENT ELECTRIC LAMP; J. McCullough, Newark, N. J. App. filed April 2, 1901. Improvement upon the preceding invention.

676,085. AUTOMATIC ELECTRIC FIRE ALARM; W. J. Brewster, Port Ewen, N. Y. App. filed Aug. 4, 1900. Details.

676,091. PRINTING TELEGRAPH TRANSMITTING APPARATUS; K. Himrod, Chicago, & J. R. Tucker & C. C. Hinckley, Aurora, Ill. App. filed March 10, 1899. In connection with a keyboard transmitter a plurality of sets of immovable pole changers are used and actuating mechanism is inserted between the pole changers and keys to successively select the different sets of pole changers with the kys.

676,092. RAILROAD SIGNAL APPARATUS; J. K. Hoddinott, Baltimore, Md. App. filed April 30, 1900. Two conductors are arranged adjacent to the track in a suitable housing where landslides are likely to take place, the crushing of the housing and consequent contact of the wires therein will set a danger signal.

676,098. ELECTRICAL CONTACT MAKING DEVICE; P. R. Papin, St. Louis, Mo. App. filed Sept. 24, 1900. Details.

676,105. PROTECTING DEVICE FOR COILS OF ELECTRICAL APPARATUS; P. H. Thomas, Pittsburg, Pa. App. filed Nov. 9, 1900. (See Current News and Notes.)

676,137. PRINTING TELEGRAPH RECEIVER; J. M. Joy, New York, N. Y. App. filed Sept. 20, 1900. Device for moving and controlling the type wheel.

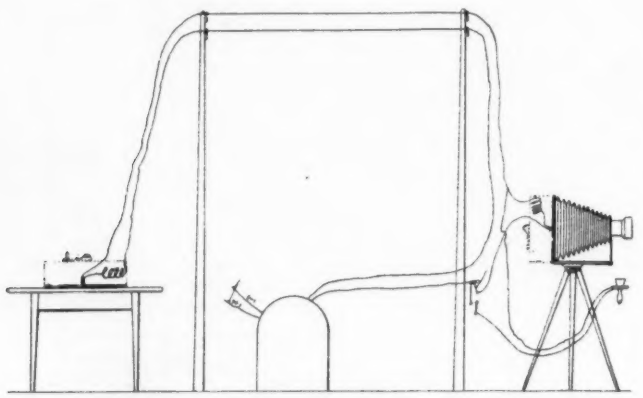
676,166. REGULATING ROENTGEN RAY TUBES; H. F. Waite, New York, N. Y. App. filed March 23, 1901. A vacuum adjuster for Roentgen-ray tubes, consisting of a shunt-circuit including in the path of the current, a volatile salt within the vacuum-inclosure, and a spark gap within a closed receptacle.

676,185. LIGHTNING PROTECTOR FOR ELECTRICAL APPARATUS; F. Gattinger, Vienna, Austria-Hungary. App. filed March 28, 1896. Consists of a number of carbon plates respectively connected in sets and in parallel with opposite terminals of a circuit wire and the ground, the plates being of such area and so arranged as to conduct to earth without sparking all of the atmospheric charge the circuit wire is capable of taking up.

676,202. INCANDESCENT LAMP SOCKET; W. H. Perkins, Waterbury, Conn. App. filed April 9, 1901. Details for holding the parts of the casing together.

676,263. AUTOMOBILE; I. Kitsee, Philadelphia, Pa. App. filed March 29, 1901. Means for controlling the operation of the motor and brake and auxiliary means for preventing operation of the motor until the brake has been released.

676,267. TRANSFORMER; W. S. Moody, Schenectady, N. Y. App. filed Feb. 23, 1901. A transformer which has a plurality of secondary windings



675,878.—Electrograph.

adapted for supplying work-circuits of different characters, one of which circuits requires a sensitive regulation and hence good inductive effect and low resistance between its secondary and the primary, and the regulation of the other of which circuits may be benefited or at least not badly affected by higher reactances; the primary and secondary windings being divided into sections which are so intermixed that there is a low reactance between the primary and one secondary, but a correspondingly increased reactance between the primary and another secondary.

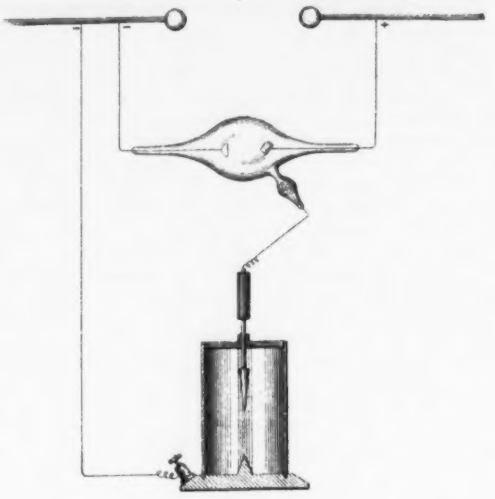
676,276. MEANS FOR SECURING POLE PIECES; H. G. Reist, Schenectady, N. Y. App. filed Jan. 29, 1900. A bolt to which the pole piece is attached passes into a radial hole, the hole being intercepted by a lateral opening through which a key passes to engage a slot in the end of the bolt.

676,280. ELECTRIC SWITCH; E. Schultz, Barmen, Germany. App. filed Nov. 20, 1900. Details.

676,281. ELECTRODE FOR PRIMARY BATTERIES; W. T. Seddon, Philadelphia, Pa. App. filed Dec. 17, 1900. Consists of carbon plates held in a lead frame.

676,289. SWITCH FOR ELECTRIC LAMPS; C. Wagner, New York, N. Y. App. filed Feb. 28, 1901. A miniature lamp carried at the end of a tube presenting the appearance of a candle is provided with a convenient switching device.

676,298. BRUSH HOLDER; A. F. Batchelder, Schenectady, N. Y. App. filed Feb. 28, 1901. A contact plate rests freely against the carbon brush and the spring rests freely upon the plate, thus assuring automatic adjustment to maintain good contact.



676,166.—Regulating Roentgen Ray Tubes.

676,300. SYSTEM OF ELECTRICAL DISTRIBUTION; E. J. Berg, Schenectady, N. Y. App. filed March 9, 1900. (See Current News and Notes.)

676,305. SYSTEM OF MOTOR CONTROL; A. G. Davis, Schenectady, N. Y. App. filed March 5, 1900. A controller comprising fixed and movable contacts, a series of separately actuated devices for moving the controller step by step and means for successively operating the actuating devices.

676,308. BRUSH HOLDER; H. Heisenhoner, Schenectady, N. Y. App. filed Feb. 20, 1901. Details.

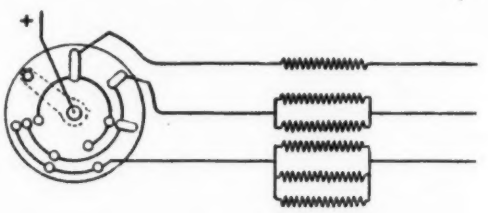
676,309. MEANS FOR CONTROLLING ELECTRIC HEATERS; E. E. Gold, New York, N. Y. App. filed March 10, 1897. A switch for connecting the coils of an electric heater in various combinations, to obtain any desired degree of heat.

676,311. MECHANISM FOR CONTROLLING AND INDICATING TEMPERATURE LIMITS; E. H. Griffiths & W. C. D. Whetham, Cambridge, Eng. App. filed Dec. 19, 1900. The indication is effected by the melting of fusible material which flows to a point where it will close a circuit.

676,332. APPARATUS FOR WIRELESS TELEGRAPHY; G. Marconi, London, Eng. App. filed Feb. 23, 1901. (See Current News and Notes.)

676,339. SYSTEM OF DISTRIBUTION; H. F. Parshall, London, Eng. App. filed Jan. 23, 1901. (See Current News and Notes.)

676,343. MEANS FOR PREVENTING COLLISIONS OF RAILWAY TRAINS; J. Skopec, Vienna, Austria-Hungary. App. filed April 18, 1900. By the closure of certain circuits, part of which are in the road bed, and other parts on the locomotive, a fluid motor in the locomotive is started, to



676,309.—Means for Controlling Electric Heaters.

pull the whistle cord, close the throttle and apply the brakes.

676,344. REGULATING DEVICE FOR ALTERNATING-CURRENT CIRCUITS; Elihu Thomson, of Swampscott, Mass. App. filed Jan. 26, 1900. Relates to improvements to constant current transformers whereby the range of the relative movement of the coils may be considerably reduced, thereby effecting a large saving in iron and scuring a more compact structure.

678,357. PROCESS OF MAKING METAL PAPER IN ENDLESS STRIPS; C. Endruweit, Berlin, Germany. App. filed Dec. 31, 1897. (See article page 1074.)

676,365. MEANS FOR ELECTRICALLY LIGHTING LIGHT SHIPS OR OTHER STATIONARY VESSELS; J. H. Junge, Cuxhaven, Germany. App. filed June 28, 1900. An electrical contact appliance surrounding the ship, by which the ship can swing at its anchor without disturbing the connection.

676,378. SAFETY TROLLEY BASE; A. C. Wolfe, Denver, Colo. App. filed Jan. 22, 1901. Details.